AMERICAN MACHINIST

August 7, 1940

Photo courtesy Westinghouse

Getting Closer—*Watt's "thickness of an old shilling" has been reduced to a ten thousandth of an inch in modern shops*

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MAJOR ARTICLES

Direct and Comparison Measurements.....*C. C. Street* 565
Simple Rules for Better Grinds.....*H. C. Urbauer* 567
Oil Well.....*H. E. Linsley* 568
Jigs for Airplane Assembly.....*H. Lasker* 570
Tools of Cast Bronze.....*Mark Golden* 574
Still Bewildered.....*Anonymous* 577
Nothing but Welding.....*William Salzmann* 579
Industry Needs Tape.....*E. J. Tangerman* 582

IDEAS FROM PRACTICAL MEN

Slotted Sleeve Holds Two Pieces.....*H. Moore* 584
Calibration of Dials.....*Aran Aghazarian* 584
Riveters Clamp Plates to Be Shape-Cut...*W. J. Tangerman* 584
Jig for Small Production.....*William B. Greener* 585
All-Welded Truck from Pipe and Plate....*Arthur Havens* 585
Grinding Large Work on a Miller.....*C. W. Hinman* 585
When a Lathe Dog Served as a Die Holder.....*C. F. Fitz* 586
One Way to True Drill-Chuck Jaws.....*Bernard T. Cook* 586
A Holder for Cutting-Nozzle Drills.....*A. H. Carroll* 586

SHORT ARTICLES

Deep Hole Drilling..... 578
Forged Cavity Shells.....*John Haydock* 581

NEWS OF THE INDUSTRY

Gaging Business..... 590b
Watching Washington. 590g
Inside Detroit..... 590i
Names in the News... 590k
Plant Expansion..... 590l
Obituaries 590l

DEPARTMENTS

What's in This Issue.. 37
Reference Book Sheet.. 587
Editorial 590a
Shop Equipment News. 591
Trade Publications.... 602
New Books..... 39

ADVERTISING PAGES REMOVED

N. H. STOVELL, *Superintendent*
Stanley Works of Canada, Ltd.
Hamilton, Ontario

"I always check advertising and new-equipment pages in *American Machinist* first."

WHAT'S IN THIS ISSUE

MEASURE FOR SUCCESS

Every so often we, like you, get embroiled in conversation with some one who insists on asking if a one-inch plug will go in a one-inch hole. You know how such conversations run. Eventually you get around to explaining about allowances and tolerances, and perhaps you pin your opponent down to admitting he doesn't really know what he means when he specifies a one-inch plug or hole. Once you get him on the defensive you're almost sure to go on about the science of measurement, about its limitations, both theoretical and practical, about latest developments in the art.

For it is an art. Down through the centuries man has perfected it, until now we can measure—accurately—almost anything under the sun. So universal is the practice of measurement that the fundamentals have nearly been forgotten by most of us. To our mind there's nothing better than a review of basic principles as preparation for the more advanced. Thus we respectfully recommend C. C. Street's article beginning on page 565, which discusses some elementary and not-so-elementary aspects of direct and comparison measurements. It's the first in a series on measurement for production—a series which will include five articles in all. Mr. Street is chief engineer of Federal Products Corporation, so knows the ins and outs of measurement for production—or vice versa—about as well as anyone.

C. C. Street, left, proves his point to John Warthen, Federal Products chief designer. Eventual outcome: greater accuracy.

SLICK

Now that production is again humming, the problem of proper machine tool lubrication once more rears its head. Wright Aeronautical, which has managed to lick most of the production problems you could name, has come up with a solution to this one too. Like most other really good systems, the method Wright uses boasts simplicity and effectiveness. And also like other good ideas, it can readily be applied in any plant, large or small. On page 568 H. E. Linsley tells about it.

H. E. LINSLEY

JIG TIME

The more sub-assemblies you split a plane into, the more jigs you can use. The more jigs you use, the more men you can employ. And the more men you employ, the more planes you can make in a given time. Such is the philosophy of Republic Aviation, which is faced with the same problem as everyone else in the aircraft industry. Even automobile men have expressed approval of the method—which is really something. How it's worked out in detail is revealed on page 570 by Hans Lasker, Republic's chief tool engineer.

VERSATILE

What do *you* think of when adhesive tape is mentioned? So do we—or at least we did, until E. J. Tangerman made us realize its many uses in industry. The fact that our attention had to be called to it made us wonder whether, if we reminded our readers of it, they might not hit on a few more ways it could save money for them. Hence the story on page 582.

ANONYMOUS!

Now and then we get letters from readers who take violent exception to what we say. Some are from our best friends, some from our severest critics. The best we've had in a long time you'll find on page 577. For obvious reasons the writer prefers to remain anonymous.

ALL WELDED

It isn't often that welding is used exclusively in the assembly of a major unit. But such is the case at the Fort Wayne works of International Harvester, where welding is the only fabrication method used in assembling truck cabs. Both stationary and moving jigs and fixtures help the welders, and an ingenious overhead tramrail system keeps the floor from getting too cluttered up. On page 579 William A. Salzmann describes them.

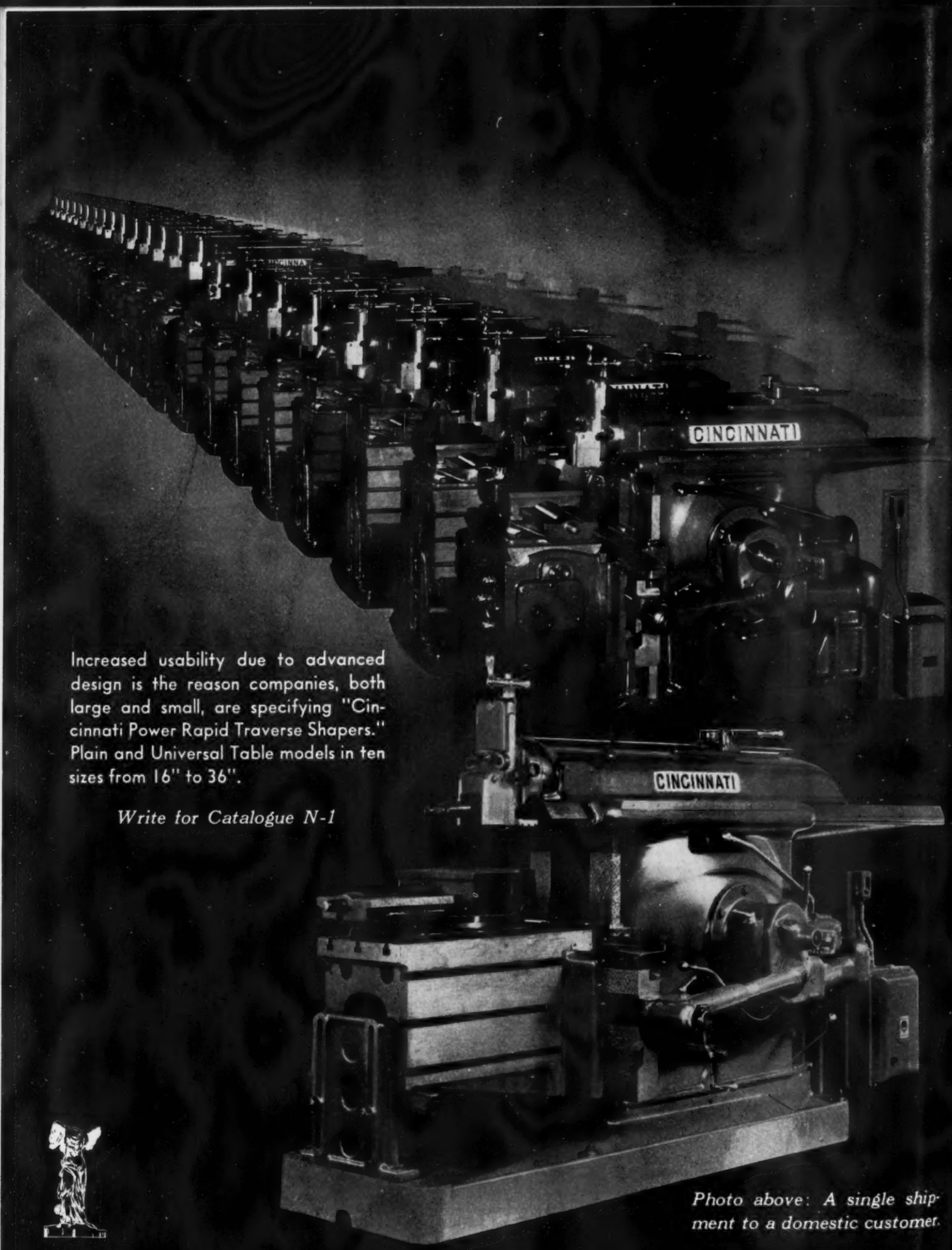
WILLIAM A. SALZMANN

BACK TO BRONZE

Time was when bronze was used for a lot of things. Still is, in fact, but you'd hardly expect to find die parts made of it. But for embossing thin steel they're satisfactory—and cheap. If you have a model of the part, making them is simple. Mark Golden tells the story on page 574.

COMING

Scheduled for the next issue is another of our extra dividends. These dividends (which, we're happy to announce, will continue to be paid pretty regularly) are in the form of special sections on the working of various materials. Apropos of the aircraft industry in particular, this next one is devoted to the working of aluminum alloys. It will be the biggest such section we've yet published—sixteen pages jammed with data. Look for it in AMERICAN MACHINIST.



Increased usability due to advanced design is the reason companies, both large and small, are specifying "Cincinnati Power Rapid Traverse Shapers." Plain and Universal Table models in ten sizes from 16" to 36".

Write for Catalogue N-1

Photo above: A single shipment to a domestic customer.

THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS · SHEARS · BRAKES

ESTABLISHED 1877 AMERICAN MACHINIST BURNHAM FINNEY, Editor

METHODS OF MEASUREMENT —No. 1

Courtesy Westinghouse Electric & Manufacturing Company

Direct and comparison measurements

BY C. C. STREET, CHIEF ENGINEER, FEDERAL PRODUCTS CORPORATION

Precision manufacture of metal parts now calls for tolerances thought impracticable a few years ago. Measurement by comparison makes it easier

CONTINUED DEVELOPMENTS in the art of interchangeable manufacture on a production basis has brought to the fore a need for rapid, precise checking of the dimensions and other factors that control the smooth working of individual parts. There was a time in industry when much faith was placed in the use of fixed gages, of which the plug and ring are examples. The rapid wear experienced with this type of gage represented a large investment to the manufacturer and was the cause of a major maintenance problem.

With the improvement in the art of "comparison measurement", these fixed gages became standards that were used only periodically. For that reason, changes in dimensions of these gages because of wear have been greatly reduced. With this change in method of measurement, a manufacturer could afford to produce fixed masters to a higher degree of accuracy than when they were made for quantity inspection. By the use of precise comparison instruments, the dimensions of these masters then could be transferred accurately to the piece being checked with a resultant increase in accuracy of the finished product.

For most purposes, size blocks of the Johansson or Hoke type are suitable as masters. Practically every machinist and toolmaker today is familiar with these important aids to production maintained by modern manufacturing plants. It is sufficient to say that a good quality size block is as satisfactory as a master gage for the most precise type of measurement that ordinarily would be met with in a manufacturing plant. Only in laboratories that specialize in extremely precise measurements is accuracy greater than that given by these blocks required.

Comparison measurement perhaps can be most clearly explained by an example. Suppose we have two bars of which the length of one is known, and it may be assumed for this explanation that this known length is an exact value, and the second bar differs in length by only a small amount from the first. If we can determine to a high degree of precision what this small difference is, we will then know the exact length of the second bar. The determination of the magnitude of this slight incremental length is the art of comparison measurement. The instrument does not tell us the length of the second bar,

nor measure the length of the first bar, it merely indicates the difference in length between them.

A micrometer caliper is a good example of a direct measuring instrument. When using direct measurement, the device tells us the size of the part measured independent of any other master or standard. The same is true of the pocket scale, the vernier caliper and many other such instruments. The distinction between these devices and a comparison instrument lies in the fact that they carry with them a standard of reference.

In the true sense of the word, even a micrometer caliper is a comparison instrument, since it compares the size of the work being checked with the amount the spindle advances along the helix of a screw thread. In using this instrument we are, in reality, comparing the work with the screw thread. The instrument still remains in the direct measuring class since it does contain a standard of length, which in this instance is the screw thread. The vernier caliper is of the same classification, for here the standard of length is the graduated scale on the column.

With the micrometer, the correct contact with the work is determined by the pressure exerted when turning the spindle, and with the vernier caliper when placing the movable jaw against the work. It has been shown on many occasions that no two workmen exert the same force on these moving parts, and that any one workman will not consistently exert the same force when making measurements. The accompanying tabulation shows this variation clearly for five measurements taken on the same piece by each of five operators. It will be noted that the errors between the readings obtained by different workmen are greater than the variations between the readings obtained by a single man taking repeated readings.

For extremely precise work there are sufficient errors in the individual readings of each man to make questionable the exact value of any single reading. Skill of a high order has been achieved by the manufacturers, and in most instances the accuracy built into the instrument is far greater than the average workman can use. In the micrometer caliper, the addition of a ratchet stop (seldom used by most workmen) provides a means for controlling the measuring pressure with a fair degree of accuracy.

Comparison measurements are quickly made in special or general-purpose instruments set to size with master gages, or blocks of the Johansson or Hoke type

Fixed masters, such as plug and ring gages, can be considered as direct measuring devices. As such they possess inherent limitations when they are used directly on the work to be measured. In the first place, when using a plug gage to check a bored hole, there may be a tendency to force the plug slightly into the hole, particularly when the hole is bell-mouthed. This produces a border line of uncertainty as to whether the part should be accepted or rejected, since the amount of pressure necessary to enter the plug is to some extent a measure of the size of the hole. In thin-walled rings, a substantial amount of expansion of the piece may be produced in this manner.

Direct measuring devices, as a rule, are incremental. An example is the pocket scale where the finest graduations usually are either $\frac{1}{64}$ in. or 1/100 in., so that when using such a device we can measure directly to an accuracy of the least division on the scale, but must estimate any fraction of this division that is needed. The same applies to plug and ring gages where a certain size hole, to be properly checked, will have a go and not-go gage. We may inspect the part with both gages and find that it comes within the specified limits, but we have no knowledge of where within those limits it lies. For some types of work, this is of no consequence.

An example might be the wrist pin used in automobile pistons. Let us assume that the nominal size of this wrist pin is 1.250 in. It may be that the manufacturer wishes to hold his maximum working tolerance to $\pm$0.0001 in. He is thus faced with the problem of allowing $+0$ and -0.00005 in. on the wrist pin and -0 and $+0.00005$ in. on the bored hole of the piston. This then would give him a maximum looseness of 0.0001 in. and, theoretically, a minimum of 0 clearance. Such a procedure as this is rather expensive.

Let us assume that this manufacturer assigns size groups to the wrist pin of -0 to $+0.00005$ in. for the first group; $+0.00005$ to $+0.0001$ in. for the second group; and so on. To determine in which group the wrist pin or bored hole would fall calls for many successive inspections with an elaborate set of plug and ring gages. Such inspection would, of course, be expensive. By comparison methods, using an indicating device, the gage need simply be set to the nominal value and have its dial marked into the proper groups. The operator then has no other task than to place the parts in the gage to determine in which group they fall, and then place them in a pan.

In general toolroom work direct measurement is usually used in preference to the comparison method. This is caused by several reasons, the most outstanding of which is the familiarity of the average toolmaker or machinist with micrometer calipers and allied instruments that have been his standbys for years. Many workmen have achieved great skill in the use of these devices. Toolroom conditions of today are much like those existing among some of the skilled mechanics at the beginning of the century. With the use of nothing more than a caliper, the old-time machinist could fit a shaft to its bearing with a clearance of only a few thousandths of an inch. The distinction between work of that type and what is now demanded by industry is that the artisan of a past day worked to a thousandth of an inch, but he did not know what thousandth.

The second article in this series by Mr. Street will appear soon.

COMPARISON OF MICROMETER MEASUREMENTS

(All measurements taken on same piece five times by each operator)

Measurement No.	1	2	3	4	5
Joslin	0.47800	0.47790	0.47800	0.47800	0.47800
Blunquist	0.47790	0.47790	0.47795	0.47790	0.47797
White	0.47795	0.47805	0.47805	0.47807	0.47803
Dutchey	0.47800	0.47798	0.47800	0.47790	0.47795
Thomas	0.47805	0.47805	0.47802	0.47800	0.47802

A backward and forward movement of a copper gage across a ground surface, parallel with the axis of the piece, shows up grooves remaining in the surface

Simple rules for better grinds

BY H. C. URBAUER, ELECTRO-MOTIVE CORPORATION

Superior commercial finishes can be produced economically in standard grinders when five basic rules are observed by painstaking skilled operators

WHEN IS a bearing surface smooth enough? Is a bearing surface ever good enough; or, just what do we mean by good enough? These are questions that arise every day in plants making machinery; and they represented a major problem to us before we arrived at a satisfactory solution.

The production of high quality ground bearings brings about serious problems for the engineer whose business it is to keep down production costs. If the grinder operator has not learned how to make a good bearing surface, the necessity of polishing or lapping operation is expensive.

If the following five points are observed, and followed carefully with painstaking efforts, any good grinder operator can produce super-finished surfaces on soft steel, as well as on case-hardened material. The grit and the grade of the wheel are only incidental, I may add, since I see operators every day produce a better finish with even a No. 46 grit wheel than others do with wheels several grades finer. It is necessary that the following points be observed:

1. First of all it is essential to know that the wheel is in absolute balance and that there is no vibration.

2. We must know that the machine bearings are tight and, at the same time, free enough to permit the machine to operate without heating.

3. Use the thinnest lubricating oil adaptable to the machine and its condition that will maintain a cool running bearing, even though you may use kerosene.

4. Be sure to keep the cutting surface of the wheel clean and free from steel particles that may have embedded themselves during the roughing operation.

5. You will not be able to secure best results unless provisions are made for filtering or otherwise removing particles of grit from the cooling solution so that none will be thrown between the wheel and the work on the last or polishing pass.

I do not wish to infer that by observing these rules one may produce bearing surfaces in competition with specialized super-finishing machines, but I do claim that it is possible to produce a commercial finish that compares favorably for all excepting special purposes. It certainly is possible to produce a finish that is far superior to those usually found.

But how are we to know when our bearing surfaces are smooth enough so that there is nothing left that can reach through the oil film to dig into the soft bearing wall. What can we furnish as a positive gage or standard of measurement by which we may isolate the fitness of a ground bearing surface?

These questions were put to us when we demanded a better finish. At that time we had nothing to offer that was practical. We worked for months in search for data that might be of help to us. Just before we gave up we stumbled over a method that now is so simple that it seems ridiculous.

Just a simple piece of copper used as a gage has solved these problems. This gage is scraped with a forward and backward movement across the ground surface, parallel to the axis of the piece, when all traces of oil have been removed and the piece is dry. We try to force the corner or edge of the gage into the steel, whether it is soft or case-hardened. If this operation does not leave copper dust on the shaft, or does not produce frayed or worn edges on the gage, we know we have a spindle bearing that is smooth enough to be used anywhere. We have eliminated friction in direct proportion to the disappearance of copper dust during the test.

At first we did not think very highly of this test method. By constant application we have learned to appreciate its value and have learned how to produce bearings previously considered impossible.

Oil well

BY H. E. LINSLEY, WRIGHT AERONAUTICAL CORPORATION

Properly controlled lubrication of all machine tools and other plant production equipment will result in reduced maintenance and greater output

THE PROBLEM of proper lubrication of machine tools assumes considerable importance in any plant engaged in large scale operations. This is particularly true if the production equipment is to be maintained at maximum efficiency for the normal life of the equipment. The highly skilled machinist may be expected to give his machine the care and attention it deserves; but the average shift worker, interested only in maintaining the maximum output, usually is content to let the machine run until it breaks down.

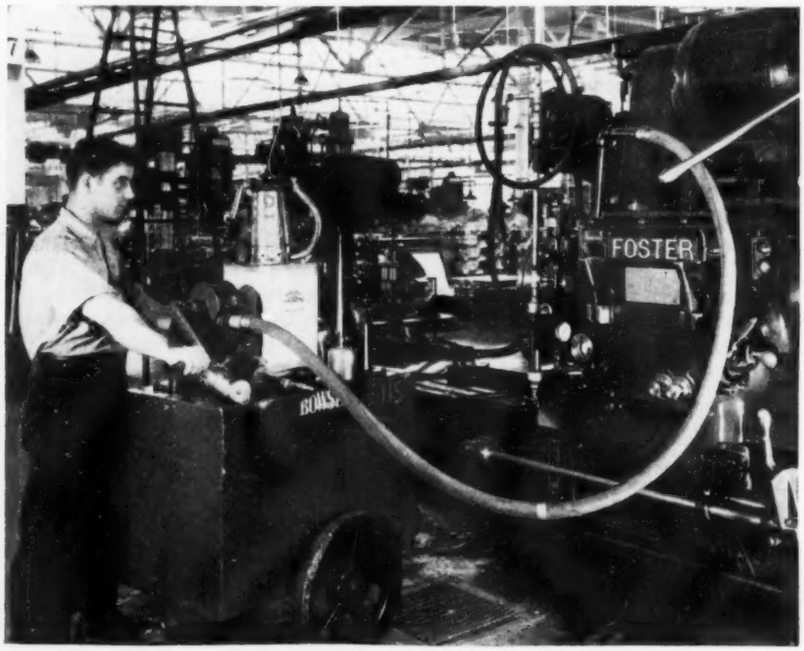
When the plant is running three shifts, this condition is aggravated by the tendency of each operator to leave the oiling job to the man on the next shift. The natural result is that nobody oils the machine, despite the fact that when running 24 hours a day lubrication is of paramount importance. The bearings never have a chance to cool off and recover from fatigue.

From the point of view of management such a system is intolerable, and in many cases the responsibility for proper lubrication is placed directly upon the shoulders of the foremen. Much can be accomplished in this way, but confusion inevitably results when each foreman has his own ideas as to what constitutes proper lubrication, and may accept or reject the machine maker's recommendations at his own discretion. It too frequently happens that some two or three general purpose oils are expected to fulfill all the requirements of the shop without regard for the widely differing functions which they are called upon to perform.

Under the constant demands for greater production, necessitating higher speeds and heavier cuts, machine tools have been growing steadily heavier. They can continue to function with their original accuracy only if the application of the proper lubricants permits smooth running of the actuating and generating mechanisms. Machine tool builders are turning more and more to automatic lubrication, with the idea of eliminating as far as possible the always fallible human element.

This brings up the question of what oils to use and what are the most suitable viscosities for lathe headstocks, high speed grinders, gear hobbers, speed reducers, hydraulic systems, and similar applications. Viscosity is not the only consideration. If the machines are to continue to operate twenty-four hours a day without breakdown, the oils in the automatic systems must be very stable.

Only when a lubricant can fulfill these requirements will the oiling systems and hydraulic mechanism continue to be dependable and automatic. Nor can the selection of suitable oils be left to the average purchasing department, since this cannot be made on the basis of price alone, nor yet on the "clear amber color" frequently regarded as a criterion by the uninitiated. A proper understanding of machine tools, and a thorough knowledge of the properties of different oils, is essential if the most economical and most reliable system of lubrication is to be worked out.



Each oiler has a special two-compartment truck with pumps for clean and dirty oil. He is responsible for all lubrication except the daily hand oiling done by the machine operator

Survey of Requirements

This problem has been solved in the plant of the Wright Aeronautical Corporation by working in collaboration with the engineers of one of the major oil companies. A survey was made of every machine in the shop, and charts were prepared showing the lubrication requirements of the machine, and the method by which the lubricant was to be applied, whether by hand, forced feed or drip feed.

Opposite each item was then listed the lubricant recommended by the machine builder, when obtainable, and also that recommended by the oil company. After these charts were completed they were examined with

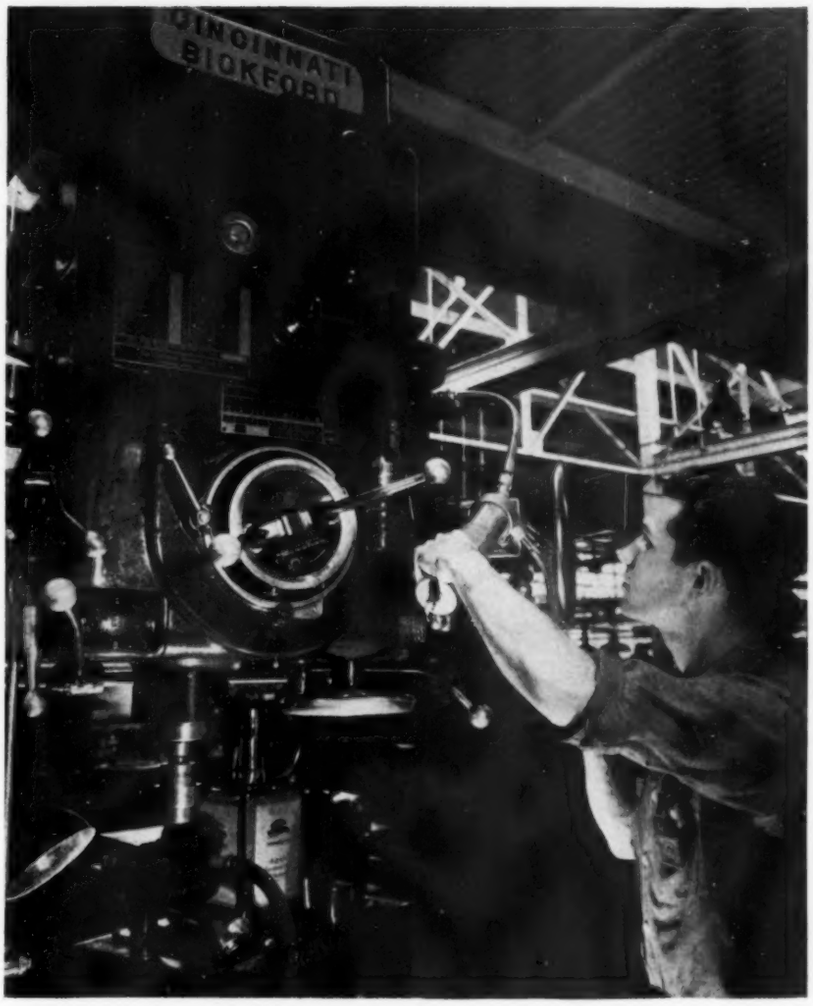
a view to eliminating any odd items. If, for example, it was found that a certain lubricant was suggested for only one or two applications, an examination was made to see if this could not be replaced by some other oil in more general use.

Log cards were then prepared in triplicate for each machine. Each card gives full particulars of the parts to be lubricated, the type of oil to be used in each case, and the frequency of application. Items requiring a periodical change of oil were indicated with an asterisk, and space provided on the reverse side of the card for filling in the date on which these changes were made. One card was placed in a transparent envelope and attached to the machine, the second filed for reference in the office of the oiler leadman, while the third copy was filed in the office of the engineer responsible for plant lubrication.

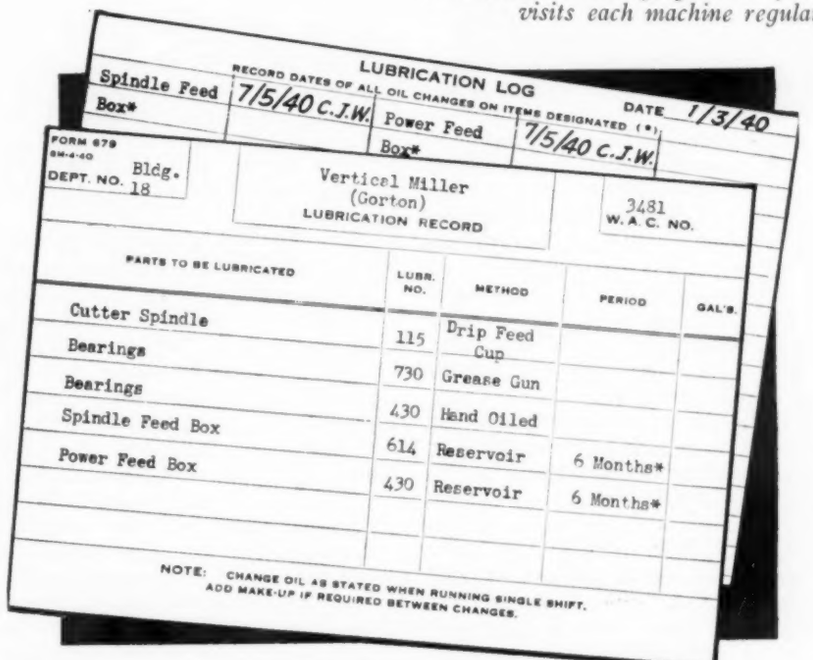
Each individual operator now is held responsible for the daily hand oiling of such parts as require this lubrication, but a special corps of oilers attends to all other lubrications. These men are under the control of a leadman who is responsible to the supervisor of the machine repair department. It is their duty to check all machine reservoirs daily or weekly, as required, and at stated intervals to pump out the oil from hydraulic systems and gear cases, and replace it with fresh oil.

Each oiler has a small two-compartment oil cart equipped with separate pumps for clean and dirty oil, and is furnished with such hand-operated grease guns and oil cans as he may require. In addition, special oil trucks have been designed for use in large departments. These serve as portable supply bases. These large trucks carry six tanks, holding about 70 gal. each, and are equipped with a sufficient length of hose to reach any machine from the aisles. Used oils of different types are kept separate so that they can be put through a reclaiming process and restored to their original condition for re-use.

In order to avoid confusion each lubricant has been given a three-figure code number by which it is known throughout the plant, and which is stenciled by the vendor on the head of each drum of oil. The last two digits, when multiplied by ten give the normal viscosity of the oil at 100 F., while the first digit designates the type of oil.



In addition to changing oil in hydraulic systems and gear cases, the oiler visits each machine regularly for a lubrication check-up



LUBRICATION LOG

RECORD DATES OF ALL OIL CHANGES ON ITEMS DESIGNATED (*)

DATE 1/3/40

Spindle Feed Box*	7/5/40 C.J.W.	Power Feed Box*	7/5/40 C.J.W.

FORM 679
SM-4-40

DEPT. NO. Bldg. 18

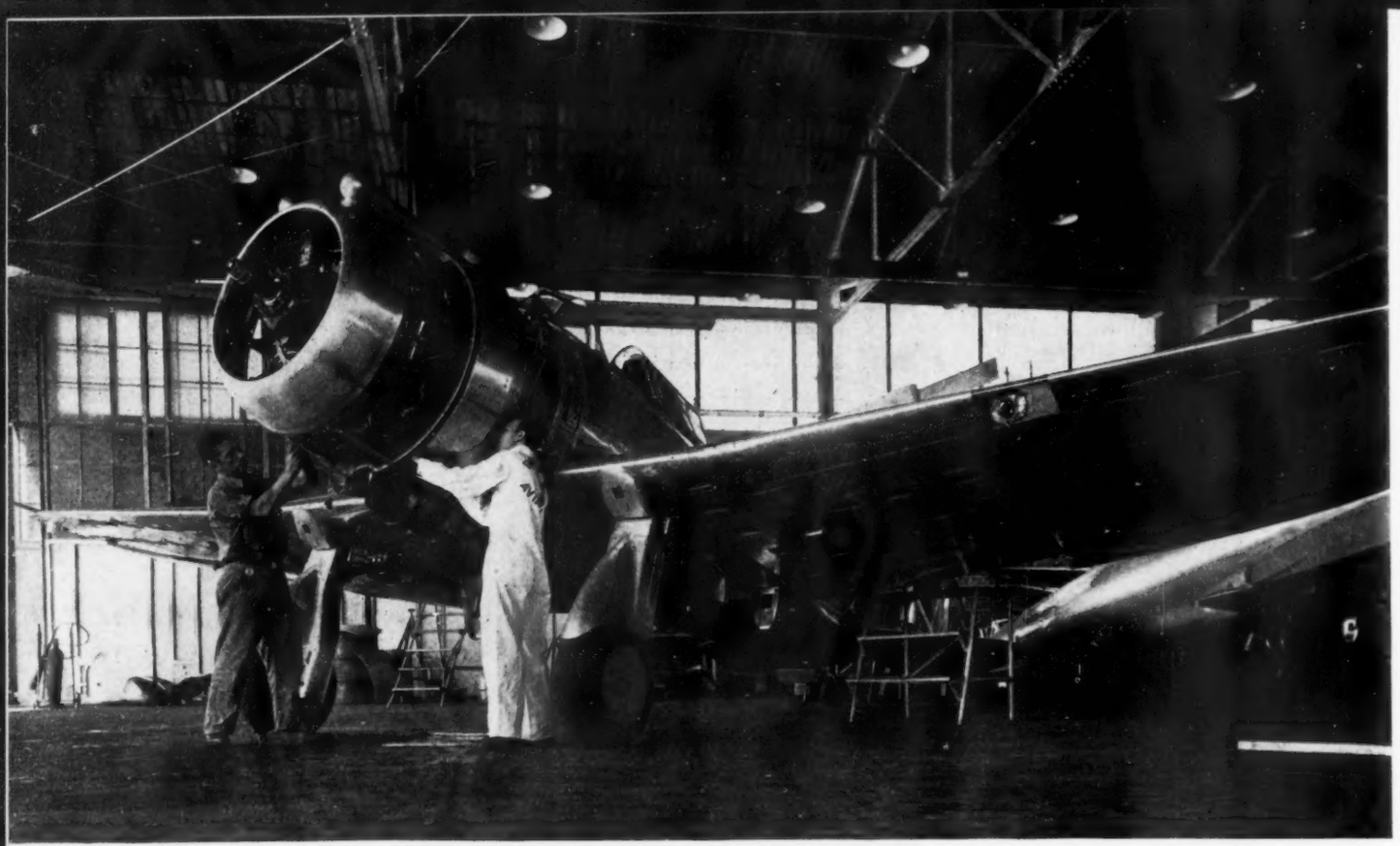
Vertical Miller (Gorton)
LUBRICATION RECORD

3481
W. A. C. NO.

PARTS TO BE LUBRICATED	LUBR. NO.	METHOD	PERIOD	GAL'S.
Cutter Spindle	115	Drip Feed Cup		
Bearings	730	Grease Gun		
Bearings	430	Hand Oiled		
Spindle Feed Box	614	Reservoir	6 Months*	
Power Feed Box	430	Reservoir	6 Months*	

NOTE: CHANGE OIL AS STATED WHEN RUNNING SINGLE SHIFT. ADD MAKE-UP IF REQUIRED BETWEEN CHANGES.

A lubrication card is prepared for each machine—a copy of this card is kept in a special transparent envelope at the machine so that the operator and the oiler each may know which lubricant to use



A Republic pursuit ship rolls off the assembly line. All component parts are jig assembled. This means more men available for minor and major sub-assemblies and faster plane production

Jigs for airplane assembly

BY H. LASKER, CHIEF TOOL ENGINEER, REPUBLIC AVIATION CORPORATION

All plane sub-assemblies are made in accurate jigs. Parts from these jigs match within close limits in later assembly jobs, thus speeding production

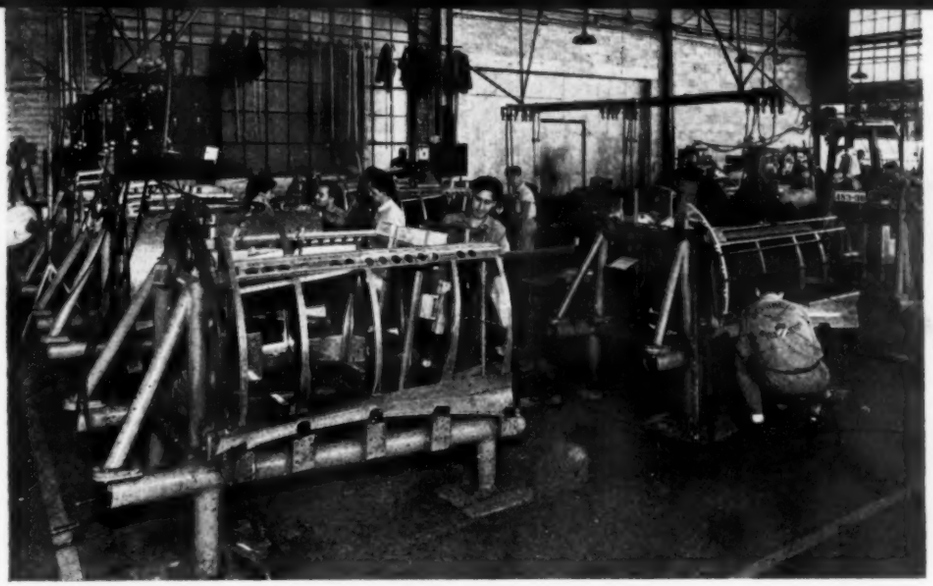
MASS PRODUCTION of planes is the goal of the aircraft industry. The Republic Aviation Corporation has attained this by using jigs for all minor and major sub-assemblies, as well as for final assembly of complete planes. The theory is—the greater the number of unit sub-assemblies into which a plane can be divided, the more jigs can be used, the more men can be employed on fabricating and assembly operations, and the faster will planes roll off the assembly line.

When a new plane is designed, the engineering and production departments confer to determine how many unit sub-assemblies are necessary for economic production of the number of planes to be built. Then a jig for each part, whether it be a wing rib or entire fuselage section, is designed with few if any removable parts so that the sub-assembly can be removed when completed without disturbing any part of the jig. Thus, the assembly men are in no way concerned with handling jig parts, and all sub-assemblies from any one jig are identical. This being true of all sub-assemblies, they mate in jigs during subsequent assembly operations.

Take the Republic fast pursuit ship which is now being built for export trade. It is divided during manufacture into two major groups — fuselage and wing. The fuselage is further divided into front, middle and tail sections, which when completed are spliced together in a jig and moved to the final assembly line. Here the fuselage meets the wing sub-assembly as a center panel, left-hand and right-hand outer panels and wing tips. For final assembly, the center wing panel is mounted on a rolling jig. The fuselage, outer wing panels, wing tips, engine assembly, retractable landing gear, tail surfaces, control surfaces and all accessories are added as the plane proceeds down the assembly line.

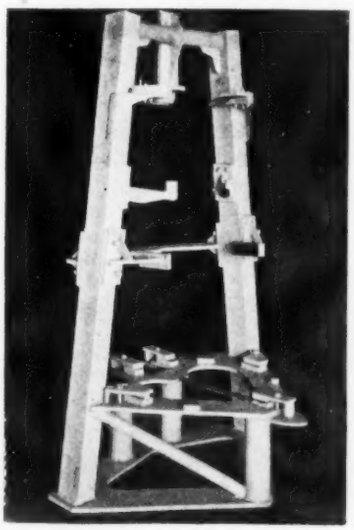
The fuselage is of all-metal semi-monocoque construction and is approximately circular in cross section. Essentially it consists of continuous longitudinal stringers, bulkhead or frame rings and a stressed skin riveted to the stringers and bulkhead rings. Engine-mount reactions are carried into the structure by four main box-section longerons.

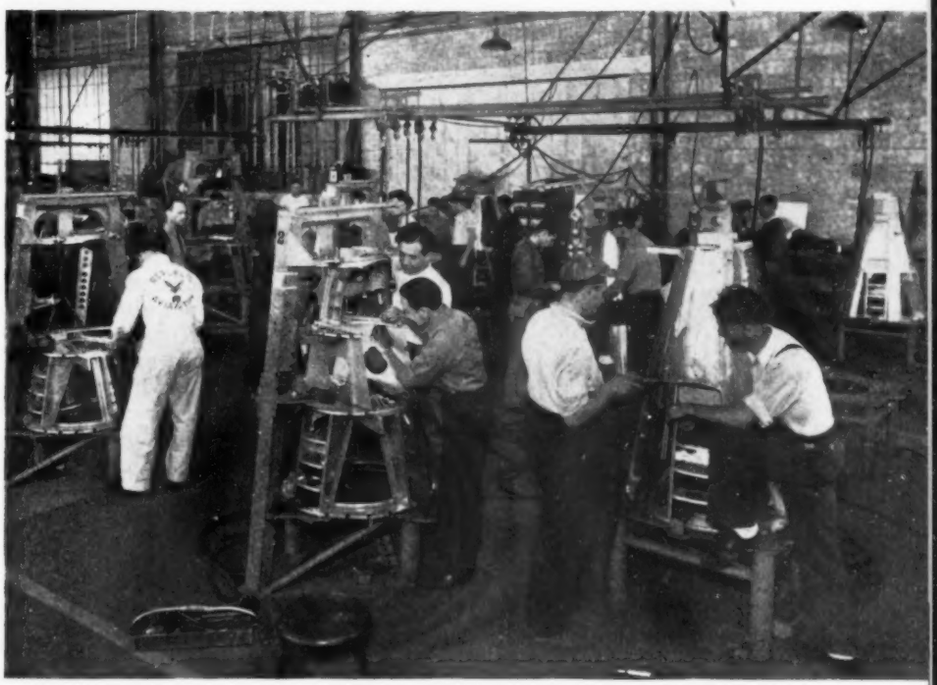
The wing is of full-cantilever design and tapers in plan form and thickness. Five main spars with fore-and-aft ribs give the necessary torsional rigidity. The center panel is bolted to the fuselage and contains fittings and wells for the retractable landing gear as well as most of the trailing edge flaps. The outer wing panels, spliced to the center panel,



Sub-assembly of the front fuselage section is typical of mass-production methods used in making Republic planes. The attaching points for the minor sub-assemblies which make up the front section are welded in position. On the other jigs for this section, the attaching points are welded in identical locations; consequently, front sections from any of the jigs are duplicates and each will match in subsequent assembly jigs

The tail section of the fuselage, assembled in the jigs at right and below, is made from jig-assembled minor parts such as ties, stiffeners and bulkhead rings. Each is drilled accurately and jigs itself as assembly proceeds. There is a minimum of fastening joints on all jigs so sub-assemblies can be removed easily when completed





carry the rest of the trailing edge flaps and the ailerons. The fuel tank is an integral part of the wing.

Each section of the fuselage and wing is jig assembled, and form what will be referred to as the major sub-assemblies. Minor sub-assemblies consist of spars, ribs, bulkheads—in fact, any part which is sub-assembled to form parts of the major sub-assemblies. We will first concern ourselves with the major sub-assemblies.

Major sub-assembly jigs are of welded tubular or angle iron construction with angles and plates welded thereto to form fastening points for previously prepared minor sub-assemblies. The latter having been jig assembled and drilled accurately, jig themselves as work proceeds. Thus a minimum number of fastening points are required on a major sub-assembly jig, and it is relatively easy to remove the major sub-assembly from the jig when it is completed.

All jigs are imbedded in concrete, leveled accurately and maintained by expert toolmakers. Assembly men are not required to remove parts of the jigs, except bolts or dowels, when removing a completed sub-assembly.

Fuselage Made In Sections

The fuselage is first sub-assembled into front, middle and tail sections and later spliced together. Bulkhead rings, the fire-wall, flooring, brackets, stringers and skin are completely drilled for further assembly.

The front fuselage section is assembled in a jig of tubular L-shaped construction. There are fastening points on the horizontal leg of the jig for bulkhead rings, and at four points on the vertical leg for the fire-wall and longerons, which carry engine-mount reactions into the structure. The bulkheads are bolted in place. The longerons are added to stay the bulkheads. Brackets, flooring and accessories are installed, followed by the stringers which are riveted to the bulkheads. The skin, comprised of flat sheets previously sheared to shape and drilled, is finally riveted to the stringers. The assembly is removed by unbolting it from the vertical and horizontal legs of the jig.

The mid-section of the fuselage is first assembled in left-hand and right-hand halves split in a vertical plane through the longitudinal axis of the ship. Both halves are assembled in

The halves of the fuselage mid-section are mounted in this jig and spliced together. Note the staggered arrangement of the skin sections riveted to the stringers; this facilitates splicing the three fuselage sections and prevents undue strains of the ship structure

one jig of tubular construction which tapers in opposite directions from a center column, the taper being that of the fuselage lines. This arrangement permits easy access by mechanics for assembly operations and installation of control brackets, electric wiring appliances, flooring, radio parts and other accessories. The jig has fastening points only for the bulkhead rings, six of which are used. When these are in place, stringers and horizontal stiffeners are added to stay the rings. Brackets, flooring, and accessories are installed, followed by application of the skin. The two halves are removed from the jig by unbolting the bulkhead rings and set upright in an inverted-cone position on another jig. The latter is merely a plate cut to match the large end of the mid-fuselage section, and set on four legs imbedded in concrete. The mid-section is completed by splicing skin strips at over-lapping points.

The tail section of the fuselage is a highly stressed unit since it transmits loads incurred during both flight and landing. The jig employed in assembly of this section is illustrated. There are attaching points for four bulkhead rings which when in place are used to locate and hold four bridges or ties. These are of heavy section and designed as uniform-load structures to replace stringers used in the front and middle sections. Additional circumferential stiffeners, as well as tail-surface and tail-wheel attaching brackets are applied. The entire tail section is completed before the skin is applied, thus avoiding difficult assembly operations in restricted space.

Fuselage Splices Staggered

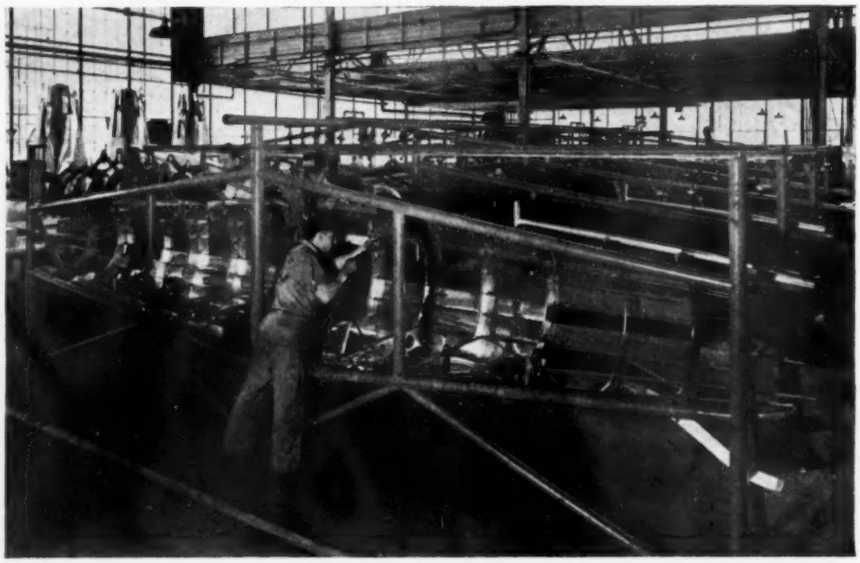
The three fuselage sections are spliced together in a jig with fastening points at the end and middle of the tail section, at the center of the mid-section, and at two points on the front section. The latter are at points used later to attach the center wing panel. The jig is merely vertical tubular-section columns embedded in concrete at appropriate spacings. Angle-iron brackets, some pivoted and some rigid, are mounted on the columns to form attaching points for the tail and middle fuselage sections. The attaching points for the front section are steel plates welded to a rectangular tubular structure. One of the illustrations shows an empty jig in the foreground and assembly operations of the entire fuselage in the background.

The skin of the three fuselage sections is left in staggered formation during sub-assembly to facilitate splicing and to avoid too great a strain on the ship at the splice points. This is clearly shown in the illustration of the fuselage assembly. The splice between the front and middle sections has been made, skin fasteners are in place, and mechanics are riveting the sheets and stringers. Other mechanics are splicing stringers and the skin between the tail and middle sections. After splicing, minor sub-assemblies, such as the crash protector, turtledeck, canopy track and windshield are added; however, the latter is removed after a proper fit has been assured.

At this stage, the fuselage is inspected and when approved is sent to the assembly line.

In the meantime, the engine is mounted on a tubular frame, which attaches to the four longerons in the front fuselage section. This assembly, together with many sub-assemblies, are sent to the assembly line. The latter includes stabilizers, elevators and rudder for the tail section; nose cowling, preheater, flap rings and flaps, and cowl panels for the power-plant section; and miscellaneous parts such as turtledeck and cockpit enclosures, windshield, fairing fillets, landing-gear fairing, and air scoops.

The wing is made up of a center panel, left- and right-hand outer



The mid-section of the fuselage is assembled in left- and right-hand halves in this jig. Mechanics have easy access to the section for assembly operations and installation of flooring, brackets and fixtures for radio and electrical equipment. Only the bulkhead rings are attached to this jig, a sufficient number of which are used to meet production demands

panels, and left- and right-hand wing tips. Spars, ribs, leading and trailing edges, corrugated sheet and flat sheet for the skin, landing gear and control-surface brackets, and miscellaneous accessories arrive at the assembly stations completely drilled for further assembly. When completed, the outer panels and wing tips are spliced together and with the center panel are sent to the assembly line as individual units.

Two Assemblies From One Jig

The jig for the center panel is designed to take two complete panels. It is constructed of tubular sections welded to form a rectangle split at the center by a vertical column. Plates welded to this center column and to the outside vertical columns serve as fastening points for spars. Additional fastening points are located on the top and bottom horizontal members of the jig.

Spars of built-up I-section are bolted to the plates on the vertical columns of the jig. Leading and trailing edges are added and fastened to both the spars and horizontal jig members. The fore-and-aft ribs are then riveted to the spars and leading and trailing edges, each rib section jigging itself by virtue of accurately space holes drilled during sub-assembly in jigs designed for that purpose. All necessary stiffeners, brackets and accessories are added before the skin is applied to avoid working in restricted space.

Corrugated sheets and skin sections are riveted to the spars and ribs on the top of the panel, while stringers are riveted to the under side. Flush riveting is used, the skin sheets having been dimpled for this purpose.

Incorporated in the center panel is an integral fuel tank, which is formed by the structure itself, the ribs and spars acting as end plates and baffles. Prior to riveting the skin to the under surface, the partially completed panel is removed from the jig and the fuel tank is water tested for leaks. Skin is then applied to the under side of the panel with riveting being done through a series of inspection holes. The fuel tank is given a final test with air under low pressure. When the panel finally comes off the jig, splice points for fuselage and outer-panel joints are drilled. It is then sent to the assembly line.

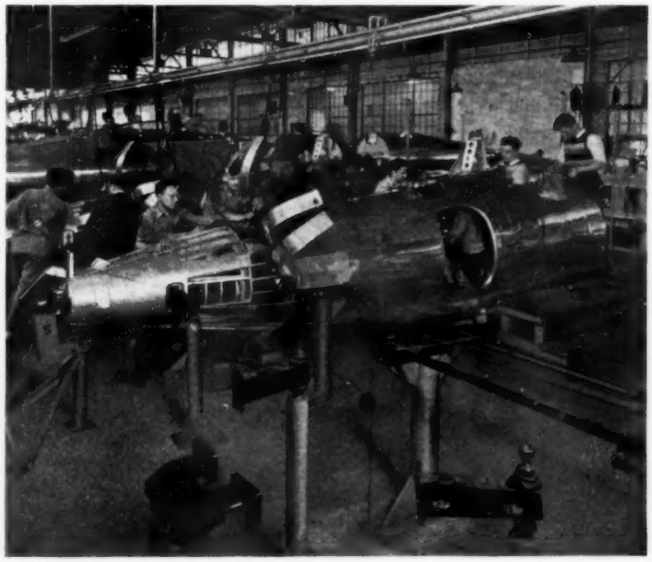
Each jig for the outer panels is designed for the assembly of one left-hand and one right-hand panel. The wing assumes considerable taper along the trailing edge as soon as it leaves the center-panel splice; therefore, the outer-panel jig is designed to conform to this shape. It consists of five vertical tubular columns of varying height. The center column, which is the tallest, is the dividing point between the left-hand and right-hand panel. An angle iron is welded to the top of the columns. Attaching points for panel parts are welded to tubular sections and lightweight angles, which are in turn welded to the angle iron mounted on the vertical columns. Additional attaching points for the outer-panel sub-assemblies are provided by plates welded to the vertical columns located between the ones at the ends and center of the jig.

Similar to center-panel assembly, spars, landing and trailing edges, ribs, brackets, accessories, corrugated sheets and skin sheets are assembled in order. Each of these parts made previously in sub-assembly jigs are drilled accurately to jig themselves as assembly of the outer panels proceeds. A minimum number of non-movable fastening points is required, both for outer and center panels, which facilitates removal from the jigs and assures identical assemblies.

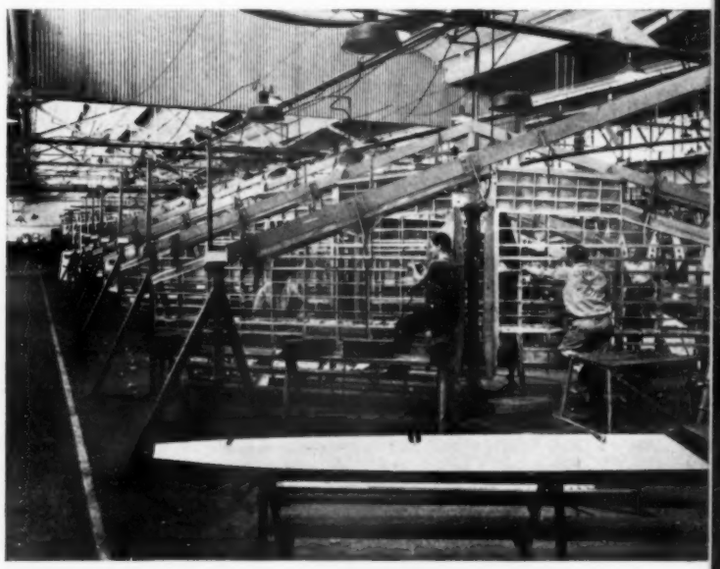
The wing tips are jig assembled from ribs, stiffeners and flat sheets. The tips are spliced to the outer panels just prior to movement to the assembly line.

Rolling Jigs for Final Assembly

On the assembly line, the center wing panel is bolted to a rolling jig, which together with another jig that supports the tail, remains in place as the plane proceeds down the assembly line. Before the first movement, the fuselage is bolted to the center panel. Then the plane is moved from station to station on the line as retractable landing gear, wing panels, power plant, tail surfaces, ailerons, cowling and nose sections, appurtenances and appliances are added.



The three sections of the fuselage are spliced together while held in a jig formed by vertical columns embedded in concrete and set at accurately spaced intervals. Attaching points, some pivoted and some rigid, are placed on the columns. Splices are staggered



Left-and right-hand outer wing panels for each plane are assembled in one jig formed by five vertical tubular columns of varying height, the center column being the dividing point between the halves. The top member of the jig conforms to the wing taper

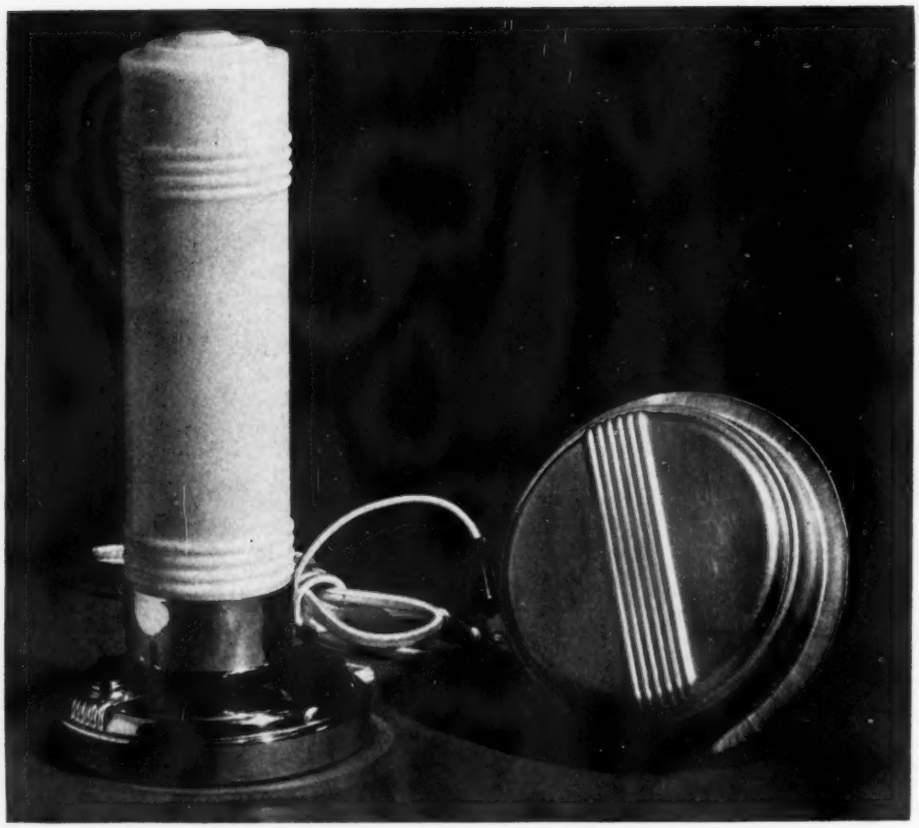


Fig. 1—The base for this ornamental lamp was embossed between bronze pieces cast in plaster molds

Tools of cast bronze

BY MARK GOLDEN

Jig and fixture parts, punches and dies are among the unique uses made of bronze castings in turning out limited lots

LONG USED in the production of castings for such ornamental parts as ash trays, book ends, handles for silverware, and similar parts cast from lead or zinc base alloys, bronze molds now are being used as jig and fixture parts for holding irregularly shaped objects. Also bronze castings have been used successfully for making forming and embossing dies for low-quantity production requirements.

In Fig. 1 is shown a lamp base with ornamental cross lines. These lines are embossed at the bottom of the stroke of the press, the top part of the drawing plug and the knock-out plug being bronze castings. While it is the general idea that die parts must all be made of steel, it is surprising how well hard bronze will stand up in this service. The die for making these lamp bases had, at the time this article was written, made about 70,000 pieces, and the two bronze parts of the die still were in fine condition.

To illustrate the ease of making bronze molds for these purposes, the production of a plaster mold for casting the bronze mold for making the lamp base shown in Fig. 2, will be discussed in detail. As the base of the wood model in this case is flat, it is placed on a sheet of plate glass, which will give a flat surface for the parting line between the two parts of the mold. Plasteline (modeling clay) is used to fill any slight opening between the mold and the glass, and to prevent movement of the model.

A wall or dam is formed of thin tin strips to confine the plaster when poured. The wall, shown in Fig. 3, is kept in place with plasteline around the bottom edge of the tin strips and at the corners. To prevent the plaster from sticking to the mold, it is coated with a parting medium made of an ordinary candle dissolved in kerosene. The kerosene evaporates, leaving a thin film of wax.

Plaster of paris is mixed by shaking the plaster into water. Mixing is carried on until a consistency of heavy cream is obtained. This mixture then is poured to a depth of about $\frac{5}{8}$ in.

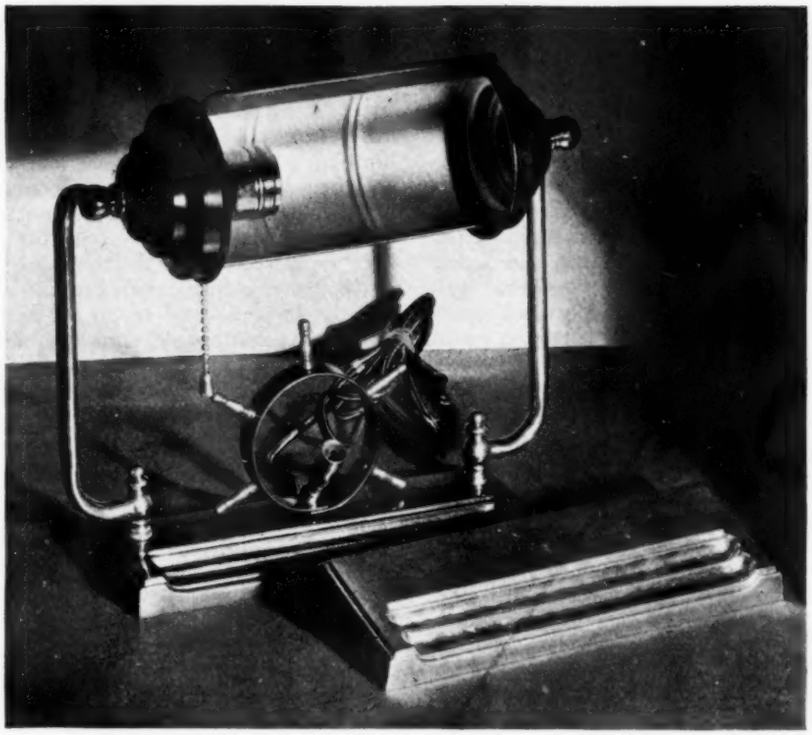


Fig. 2—The base for this reading lamp is made from an alloy of zinc and aluminum, and was cast in bronze molds

alignment. The first cast with the model imbedded is next prepared with tin strips and Plasteline as shown in Fig. 4. It is coated with the parting solution to prevent sticking of the second casting.

Second Cast Like First

A second lot of plaster is mixed and poured. After this plaster has set the tin strips are removed and the two parts are easily separated because of the wax coating on the first half of the mold. The plaster is trimmed to remove excess material so that about $\frac{1}{2}$ to $\frac{5}{8}$ in. is left all around. The two halves are cut along the lines previously marked by indelible pencil to form the gate for pouring the metal to be cast. The back of the plaster cast is marked with a circle $\frac{5}{8}$ in. in diameter to designate the point at which a shank is to be cast. This shank is used for handling the mold in operation.

The two halves of the mold are finished by hand, using scrapers, riffle files, and punches. A motor with flexible shaft is frequently used to save time and labor. In Fig. 5 is shown the finishing of the mold top

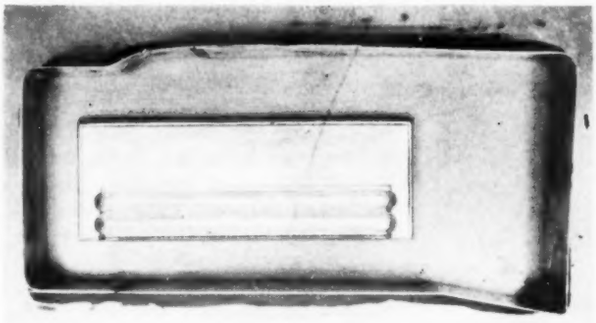


Fig. 3—First, the model is placed on a sheet of glass, and a wall of tin strips is held in place around it with modeling clay

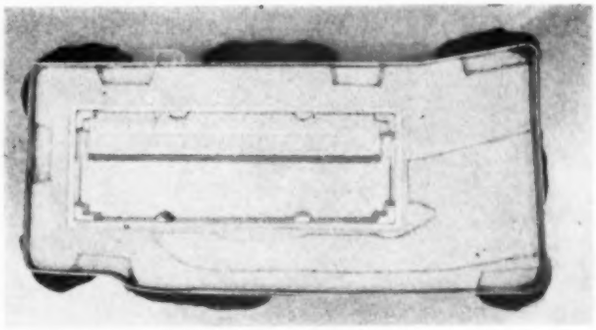


Fig. 4—The first plaster casting, still with the model in place, is turned over and arranged for casting the second half of the mold

over the highest part of the model The plaster then is allowed to set until it hardens. The plaster warms up as it gets hard, and the cast cannot be removed from the form until it has warmed up, or the casting will break.

The model next is prepared for casting the second half of the mold. Locks are cut in the plaster and the pouring gate is marked with indelible pencil. The locks locate the two halves of the mold accurately. The line marked with indelible pencil will be transferred to the second half of the mold, due to the moisture of the plaster. This permits the pouring gate to be cut in both halves in accurate

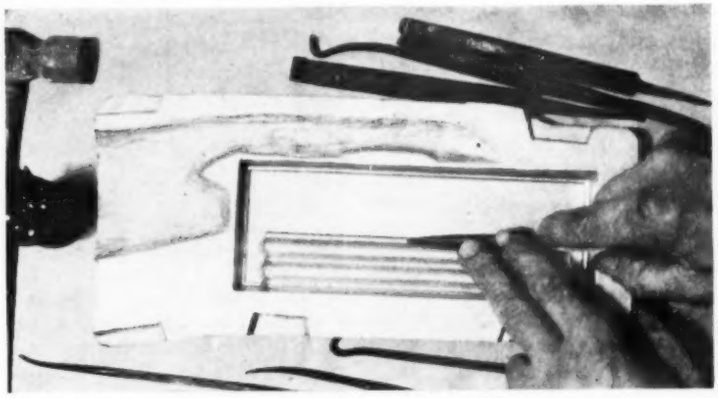


Fig. 5—The mold halves then are finished with hand tools to make them ready for casting the bronze pieces

Fig. 6—These bronze molds cast from plaster parts have been in use for more than three years and have cast thousands of lamp bases

to remove on this type of casting.

There are two types of metal used for casting in bronze molds. The first, and original metal used in this work, is a lead composition consisting of 86 to 88 per cent lead, and the balance of antimony to give hardness. The second metal was developed to overcome the fragile qualities of the lead composition. This second type contains 94 per cent zinc, and 6 per cent aluminum, and is known as "unbreakable" metal. It very nearly lives up to its name, since it takes a good blow with a heavy hammer to crack an ordinary casting.

In making the bronze parts for the die to emboss the lamp base shown in Fig. 1, a cylindrical plug of plaster paris is cast in a form made of thin sheet steel bent into a tube 5 in. in diameter. The tube is placed on a flat surface and reinforced with modeling clay. After the plaster cast in this mold has set, it is turned to the proper shape in a lathe. In this instance, it is turned to the shape of the male member. The ribs are made by brushing white shellac over the parts and then dry plaster paris is built up on the pattern. The plaster will not adhere to the pattern unless it first has been shellacked to close the pores.

After setting, the lines are carefully laid out in pencil and rough cut by knife. The finishing is done with a flat piece of steel filed to the proper shape. When the male pattern has been completed, the pattern is brushed with the separating medium made from candle and kerosene, and the steel tube is placed around the casting to prepare for making the female part of the die. This part of the work is done as in casting the second part of the mold described above. When the plaster has set, it is trimmed in the lathe. Corresponding "V" notches are cut on the periphery of the plaster halves so that these halves can be matched when fitted together for making the castings.

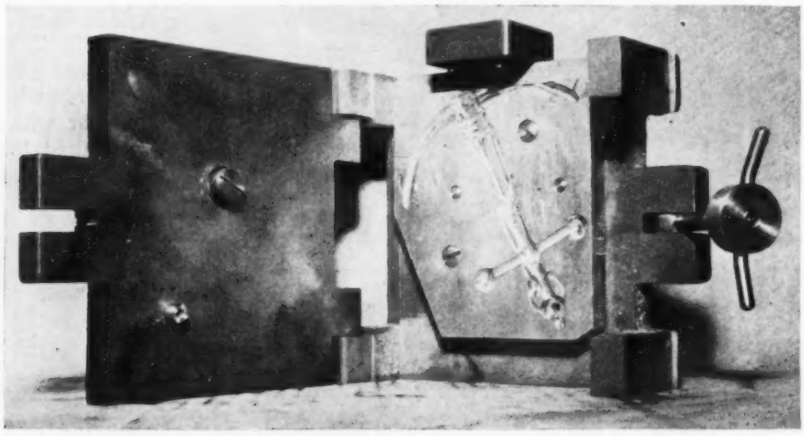


Fig. 7—A bronze casting made from a plaster master is used in this drill jig to position an anchor for a decorative lamp

half with hand tools. When ready for casting bronze molds, Fig. 6, the two plaster mold halves are fitted together using a mixture of whiting and alcohol.

The mold described above is for solid castings. Another type is used for making thin hollow castings. The molds are called slush molds, since the metal poured into the mold is slushed around and poured out into the ladle. Since the bronze mold is never allowed to become hot, the poured metal leaves a layer of metal on the inside wall of the mold.

Water-Glass Stops Sticking

The pouring gate on solid castings sometimes is broken off. At other times it is sawed off, depending on the casting. In the case of slush or hollow castings, the edge of the gate is painted with silicate soda (waterglass). This resists the tendency of the metal to stick to the wall of the mold. There is, therefore, no gate

Fig. 8—This mold was used for casting the bronze part shown in Fig. 7. Modeling clay is used to build up to the center line of the part in making this mold from the sand-cast piece

Castings for Jig Parts

A novel use for bronze castings is in making jigs and fixtures for machining operations. A good example of this use is the drill jig for a cast anchor shown in Fig. 7. This anchor is part of a marine-design table lamp. In making the plaster pattern, the anchor was imbedded in modeling clay to the center line and a frame formed of thin steel strips imbedded in the clay. In Fig. 8 can be seen the anchor prepared for casting the plaster. After the plaster sets, the steel strips were removed, and the plaster cast removed. The casting resulting from this operation was then trimmed to remove excess plaster and shellacked. The bronze casting made from this pattern is machined and the casting fitted into the impression by filing. Where small pieces are to be handled, the shrinkage of the bronze is not enough to cause excess labor in finishing. On large pieces, it is advisable to enlarge the impression in the plaster a little in order to save work in finishing the bronze part.

The bronze block is mounted in a cast iron jig, to make the completed unit shown in Fig. 7. Two bushings for No. 33 drills were inserted in the projecting block at the top of the jig. A No. 18 drill bushing was put in the jig cover. A pressure button is also located in the cover at the proper point to apply spring pressure to hold the casting firmly in position during the drilling operation.

Still bewildered

ANONYMOUS

Not long ago I read your editorial, "Bewildered—Not Lost." I feel many other men who read it had the same reaction I did; I could hardly believe my eyes!

IS IT POSSIBLE that a business paper can publish a pep talk like this, which might have been applicable twenty years ago, but which certainly does not take into consideration the conditions that exist today? Let me picture for you John Doe's Jobbing Machine Shop, and you will see that the title is true, but in an entirely different sense than intended.

John Doe employs 50 men. When he is busy, he can build this force up to 100, and at such times feels the need for skilled men very badly. His shop is 100 per cent union, pays union wages, and follows all the rules laid down by the NLRB without getting into too much trouble. For years he has had apprentices, giving them a four-year course in which they learn all he can teach them. There is plenty of supervision to help them learn their trade, the shop has modern machinery of various kinds, and several of them, emboldened by their success, have branched off into the mechanical business.

If you assume that each of these 50 employees has a son who might want to follow in his father's footsteps, there should be an opportunity for at least 25 men to learn the trade—but is there? The answer is definitely no! The union regulation is very strict, there can be only one apprentice to ten employees, and so this shop can have only five apprentices, and, mark you, one of these must finish his whole four years before another can be taken on.

You might assume that the practical thing to do would be to point out the danger of this restriction, to show the men that these tactics, laid down by some union organizer, will only tend to keep their sons on relief. Perhaps they should be told the truth: that this artificial scarcity will not result in fabulous wages, for wages are entirely dependent upon the consumer; that Mr. Doe would be tickled to death to make a five per cent profit on wages of $3 an hour instead of $1, if he could get this kind of money for his work. But this simple lesson in economics can never be given, because the law says it is "coercion," and heavy fines and jail sentences are imposed for just such criticism, which is construed to be an attack on the unions and their tactics.

The front door of John Doe's shop opens, and a man comes in and says:

HELP WANTED
EXPERIENCED OPERATORS on Multiple SPINDLE AUTOMATICS
ASSEMBLERS with EXPERIENCE ON PRECISION APPARATUS
Apply at GATE

Isn't it pathetic to realize that this young man is facing strangling regulations to prevent him from ever learning a trade properly?

"I saw your ad in the paper, and I can run a lathe a little; I worked at Brown's and I need a job. I don't want to be on relief. Can't I start in? Pay me only what I'm worth."

John tells him he can't use him, but he's not permitted to tell the true story. He can use him, yes; he has work he could do well enough. But these are the restrictions: First of all he must join the union; if he is a new member he must pay an entrance fee; if he previously belonged and dropped out there may be a $25 fine (after six months on relief, where can he get it?). Furthermore, if he is hired and runs a lathe he must be paid $1 an hour. John knows he can't earn it (and never can until he gets experience), and so he dares not hire him, let him learn more about the business, and take him off relief.

And then there is seniority. *A* and *B* are planer hands, who have worked for John Doe a long time. They have been laid off during slack periods, but they always come back. They must, because they are not good enough to get a job in open competition. But during a busy period John hires *C*, who, strange as it seems, is a good machinist, much better than *A* or *B*. If *C* could be kept employed the shop could take work in slack periods, work that would provide jobs for helpers, and lathe hands, and bench men; but *A* and *B* are not capable of doing such work, and if *C* does it, *A* and *B* must be working, and their wages, entirely unearned, added to the cost of the job. So John Doe bids and loses the work, and half a dozen men collect unemployment insurance. This is seniority.

Perhaps John Doe gets slack, and a lot of his men take time off. The good ones could find work, but to take a job costs them their seniority, and so they stay at home, collect

government dole, and look at their sons who have small chance to learn a trade and support their parents in the future. This also is seniority.

A few weeks ago John called in the union committee, and the organizer. "Boys," he said, "you all know Joe. We hired him as a laborer a few years back. He's done pretty well. You know he supported his mother till she died, and now he wants to get married. He's too old to be an apprentice, but we can get a lot of shaper work now, and I want to put him on this machine. I'll give him a raise, and when he gets good enough I'll pay him the regular rate. That way he'll learn some kind of a trade, and will be able to get a job if we get too slack and have to lay him off. He isn't going to take any other man's job, because I can get work just for him. I can't pay 90 cents an hour, and I can't get work at a price that will stand it, either. What do you say?"

Can you guess the answer? That's right, it was no. And Joe has never been told, and never will be.

Stay on Relief

Day before yesterday John Doe had another session with the committee.

"We're mighty busy now," he began, "and I want to put on two new apprentices. You all know Frank, the errand boy, and Eddie, Barney's son. Barney wants him to learn a trade, and if he's as good as his father and brothers, he'll be a good man.

"Now I know we've got our full complement of apprentices, and ought to have twenty more men before we put these kids on. But Sam and Denny will be through their time in three months, and meanwhile we have a lot of work, and these kids will get a good start.

"We've tried everywhere, advertised and everything, and have only been able to get five men. You fellows know I'd hire 25 men tomorrow if I could find them, and I could get work for them, too. Barney's kid will do all right, and so will Frank. I don't want to crowd you on the rules, but you can see how it is. With more man power, I can take more work and have jobs for all the mechanics, and for a longer time, too. How about it?"

Do you know the answer, Mr. Editor? Yes you do too! And can Barney be told all this, that his son better go on relief for another six months? Yes, John can tell Barney this, but he can't tell him why. This, my friend, is criticism, and therefore "coercion," and by the same measure illegal.

Six months ago a man came in to see John Doe. He introduced himself as a professor in a local vocational school.

"We are trying," he stated, "to teach our young men the kind of mechanical knowledge that will be of actual practical value when they go out to get a job. I have here a list of questions, which I would appreciate your answering; I would like to see the kind of work you do, and what blue prints you work from; and will you tell me exactly what I should teach my students, so that when they finish the course they will know exactly what you yourself would want them to know?"

The boss told him what he wanted to know, but what he didn't tell him was that his students would never get a job with him, because he must either pay them the full union rate (which they couldn't earn), or if they could bluff their way enough to get a job running a machine, they would be shackled by the system to running that machine until they died, without a chance to work at the machinist trade which they had selected.

"I'm just past 21. I've had about two years of machine shop training. I can do any operation on a lathe, and I've had some experience with a milling machine, shaper and drill press. I would appreciate a chance in your shop either on day or night work. I'll work for any pay just so I can have the opportunity of working in a machine shop. I want to learn all of the trade I possibly can, because the work makes me feel good when I do it."

Half a dozen letters a week, just like this (this is quoted verbatim), and to what purpose? From them shine a pride, inherited from ancestors who faced the world with their skill in their two hands, and earned a living, and raised a family, and who should now retire to smoke their pipes in the sunshine on their children's porches. Isn't it pathetic to realize that this young man is facing strangling regulations to prevent him from ever properly learning a trade? Regulations that will force him (if he does find a job) to pay taxes that are used, not for training his children, but for continuing a system that will prevent new generations of mechanics from being trained to carry on the tradition of the greatest industrial country in the world.

What, Mr. Editor, would you do about that letter, about those untrained young men, about those half-trained older ones, when you realize that only one in ten has a chance at proper training, under a system fostered by government and maintained by strike and violence? Certainly American industry wants to train new men, knowing how badly they are needed, and fully realizing that some future "M-Day" will bring this home sadly to the population of the country.

Fallacy of Scarcity

The system of regulation that either sadly restricts the number of men trained in jobbing shops or discourages such training altogether is sold to American workmen on the platform of "scarcity"—that more mechanics will lower wages, put older men out of work and destroy their security. Only the press can point out the fallacy of this, by showing that the security of the nation and of the industry is the only thing that will make permanent jobs for the mechanics and their children.

Industry can be expanded, more men employed, and more uniform employment made possible, only if both industry and its workmen can be freed each to run his affairs as he sees fit, in open competition with no favors to anyone. Perhaps you could conjure up an industrial Abraham Lincoln!

Deep Hole Drilling

DEEP HOLE DRILLING in the machine shop is a special job that few like to handle. Rifle barrels usually run from 0.22 to 0.30 in. and are rarely over 24 in. long. Cannon usually run from 3 in. to 12 in. with a few of 16 in. The lengths may run up to 50 ft. But for real deep hole drilling the oil industry leads them all. Oil country shops think nothing of putting a 3- or 4-in. hole through a drill rod or shaft 50 ft. long.

So much for metal. When it comes to deep holes in the earth the record is 15,004 ft., with the lower 2,200 ft. only 6 in. in diameter. The mere thought of a drill nearly three miles long makes one wonder as to the torsion in the drill, the weight to be supported and the amount of power required.

Of course the holes are not straight, as is necessary in machine shop work. But it's a job that would cause many a headache to one without experience in this line.

Nothing but welding

BY WILLIAM A. SALZMANN, PLANT ENGINEER, INTERNATIONAL HARVESTER COMPANY

Spot welding alone is used by International Harvester in the fabrication of truck cabs. The technique developed could be profitably applied elsewhere

USING SPOT WELDING exclusively, an interesting method of progressively assembling sheet metal stampings into truck body cabs has been placed in operation at the Fort Wayne plant of International Harvester Company. With some 20 operators handling the 24 pieces of welding equipment, production is currently 90 cabs per 8-hr. shift.

Welding equipment is located so that parts from each welding station feed directly into the succeeding operation, eliminating inter-operation storage and duplicated handling of sub-assemblies. The entire set-up has a production line aspect, yet without the apparent "urgency" commonly associated with it. Parts to be assembled are conveniently located at the various welding stations, where they are incorporated in the cab assembly as it is built up. Latest type of hydraulic spot welding guns are used. These, together with individual air-hydraulic pressure boosters, transformers and the necessary special guns, welding fixtures, jigs, and other auxiliaries, were supplied by Progressive Welder Company.

Tools Hang From Monorails

To conserve the operator's energy for productive work and save time in moving the portable equipment at each welding position, most of such equipment is suspended from overhead tramrails capable of being moved in two directions with minimum effort. Except where installed in the welding fixtures, such equipment as transformers and air-hydraulic pressure boosters are also suspended from the overhead tramrails.

Automatic welding timers, supplied by Weltronic Corporation, are of the repeating type, eliminating dependence on the operator for correctly timing the weld. The timer automatically controls weld, cool, and repeat time. It also permits the operator to maintain pressure on the control button while making a series of spots, the "off" time being sufficient for repositioning electrodes for the next spot.

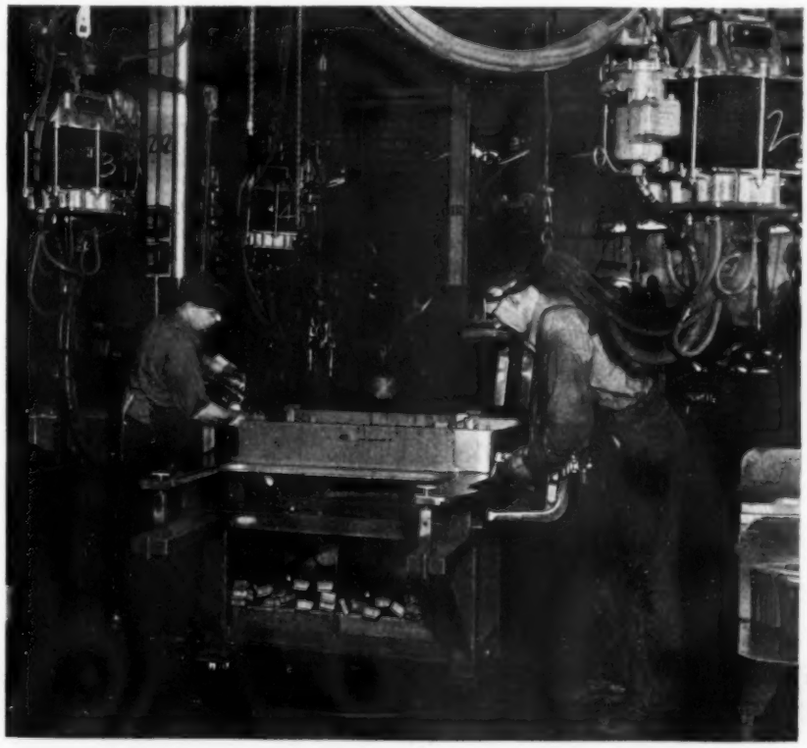
Under such continuous repeat operation, it is essential for the duration of each weld to be in exact conformity with the time called for by the timer setting. Westinghouse Weld-O-Trol contactors of the Ignitron tube type are used at all welding stations. Control of welding current with this type of contactor reduces sparking and welding point wear. Timers and contactors are placed overhead, adjacent to the tramrail supporting the equipment they control.

General layout is such that two lines of spot welding guns and pedestal welders converge upon a single major cab frame assembly fixture. Spot welding on one of these lines begins where two portable pincer type guns weld windshield panel to post, hinge pillars to post, and miscellaneous brackets, to form the H frame. Both guns have independent transformers and timers, and are suspended on tramrails to permit rapid shifting in any direction.

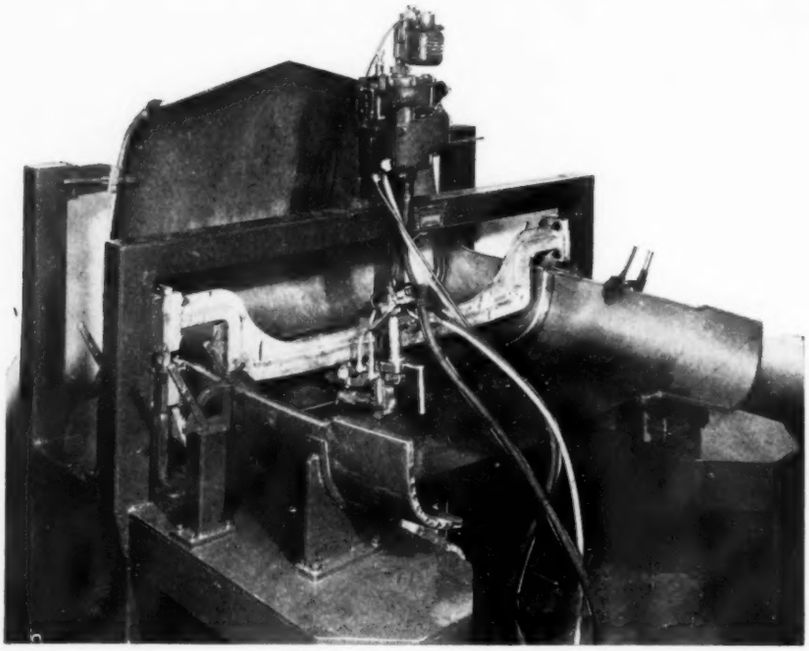
Some Welders Interchangeable

A pedestal welder used for welding bracer strips and clips to the dash on standard cabs is also used interchangeably for welding cowl assemblies for special cab jobs. Another pedestal welder handles lock pillars, cowl, ventilators, reinforcements and miscellaneous parts to complete the operations of the first assembly line.

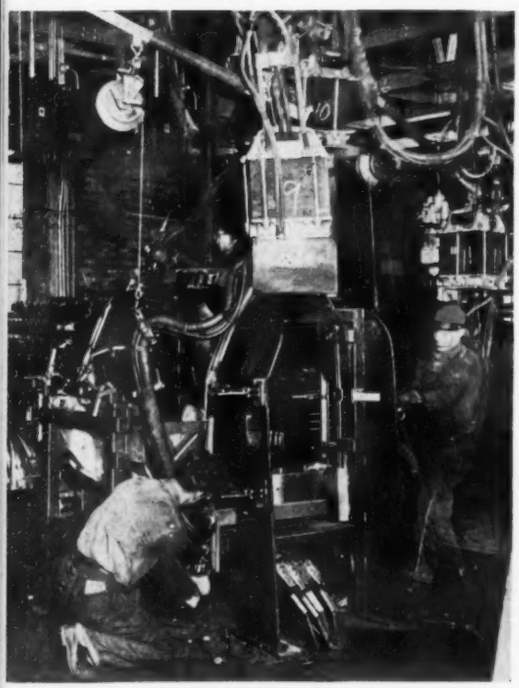
The cab underbody is similarly assembled on the second line. The sill frame is placed on a combination jig and welding fixture and on it the



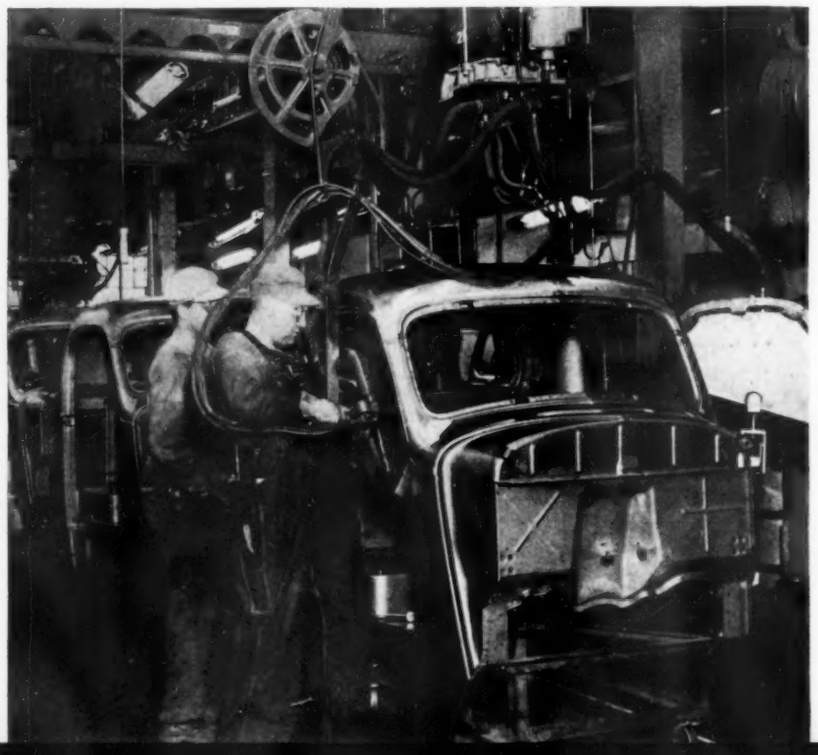
One of the initial sub-assembly spot welding operations in the all-welded method of assembling truck body cabs at International Harvester's Fort Wayne plant. Here underbody sub-assemblies are being built up solely by means of spot welding



Top and back skin are assembled in this welding fixture, which has the transformer located in its base and the pressure booster and controls mounted on the cross arm. Scissors type expansion gun is in operating position



Major cab frame assembly fixture receives underbody sub-assembly from the line No. 1 and H frame from line No. 2 for assembly into completed cab frame. Four portable spot welding guns are used by three operators at this welding station, one working inside frame



In completing the drip mold welding operation, right and left hand door frame fixtures suspended from a tramrail follow the cab along conveyor line. Short circuiting gun is used for both right and left hand doors, current being carried through fixture

underbody is built up. The various parts comprising the cab underbody are hand clamped, pinned in position and welded, two operators loading and welding the work. One gun is used for vertical spots while the other is used for horizontal work. They are independently suspended and have separate transformers, boosters, timers and contactors to permit simultaneous operation.

Welding on this line is completed at a second station. Here a swivel-head gun, to allow access of points over deep work, permits the tool box and seat riser to be built up as an integral part of the completed assembly.

The two lines converge on the major cab frame assembly fixture. The underbody assembly and the H frame assembly are located in this fixture with hand clamps. Three operators using four guns complete the assembly of the cab frame and weld miscellaneous reinforcements. Two operators work outside the fixture, while the third working inside handles spots more readily accessible from the interior. The cab frame assembly is then removed from the fixture and placed on a body truck to be pulled along the main assembly line by a floor conveyor.

Station Strategically Located

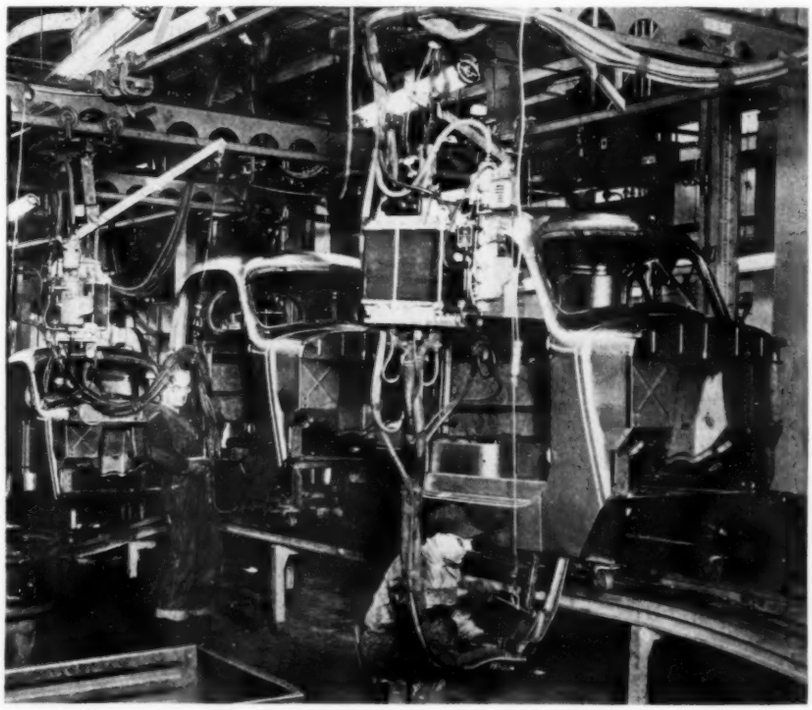
While the assembly of the cab frame is progressing along the two welding lines, the assembly of the roof and back panel is being accomplished near the conveyor line loading point. In a self-contained fixture the top and back are joined by a scissors type expansion gun. The rear window frame is positioned with double Y clamps and welded to the cab top with another pincer type gun. At

this same station the seat cushion back and reinforcing strip are welded in position. The cab skin is positioned on the cab frame on the conveyor line, and is immediately tack-welded along the bottom of the back panel to the frame to insure proper positioning.

A third pedestal welder is used for the cowl assembly. This welder completes the necessary welding of hood bracket reinforcements, hinge clips for ventilator and guide for rod brackets. Upper and lower cowl panels are welded with an expansion gun in a fixture, and the completed assembly is brought to the conveyor line and put in position. Two guns are used for welding right and left hand door frames to the skin and a third gun welds cowl to dash.

As soon as the inside trim has been welded on with a pincer gun, right and left hand door frame fixtures are swung into position and locked by an expansion rod. Both sides of the transformer are connected with the fixture. The operator handles the short circuiting expansion gun while a helper holds the drop molding in position until the first tack weld is completed. The helper then positions the molding just ahead of the next welding operation.

At this point the conveyor line travels over a hump which permits easier access to the lower portions of the cab. A single long-jaw pincer gun is used alternately by two men to weld the lower skin to the frame at the rear of the cab. Another deep-throated gun welds the kick plate to the cab sill, the plate having been clamped in position previously as the cab approached the hump.



Final spot welding operations are completed on the conveyor hump. Tramrail permits one gun to be easily moved for operation on either side of the conveyor line

The next operation comprises an effective application of overhead tramrails. Here a fixture suspended from the tramrail carrying the transformer and pressure booster is lowered into the windshield opening to weld the top to the windshield. Work is secured with hand clamps and is welded by a spade-handle expansion gun. When this welding operation is completed, the gun is placed on the fixture and the complete equipment raised to permit the assembly to pass under it.

Final spot welding operation uses a deep-throated pincer gun with offset electrodes to complete the welding of kick plates to the cab assembly. In the photograph above is illustrated how the hump provides clearance for these final welding operations, permitting the operators to have rapid access to the work without the necessity of climbing into the cab.

Forged Cavity Shells

By JOHN HAYDOCK

My reaction to the forged cavity artillery shell was somewhat the same as that of Lucien I. Yeomans (*AM*—Vol. 84, page 526) until I had an opportunity of investigating the method of manufacture used at the Frankford Arsenal. What I found convinced me that 75-mm. shells made without machining the bore will meet ballistic requirements, and that this is the sensible way to make them.

Consider the following:

The shells are not rough forged but precision machine forged. The bore is held within 0.020 in. of size and concentricity. The outside is held within $\frac{1}{16}$ in. runout with the bore. This control of runout means merely that the shell will clean up and when the stock is removed the difference in cutting pressure between one side and the other will not cause deflection.

Shells are indicated in the bore to assure proper size and roundness.

The arbor has six expanding contact pins—three at each end. The outer set is positively actuated and the inner set spring actuated, an arrangement which assures that both sets will grip the shell—that the contact of one set will not lock the other.

Pins are ground with the arbor in the spindle of the machine insuring concentricity in the working position. A master shell machined inside and out is indicated on the arbor daily.

Centering is done on this arbor. Subsequent operations are carefully designed to maintain the uniform wall thickness thus obtained.

In the past I have heard manufacturers complain of unnecessary operations caused by the insistence of Army and Navy specifications. It seems to me that the elimination of the boring operations on the artillery shell is a realistic step in obtaining economical production without unnecessary flourishes. Anything that makes the defense dollar go farther is a move in the right direction.

Steam Got Tired

I WAS INTERESTED in H. M. Lane's account of the straight line engine. It recalls a conversation with Prof. Sweet, something over 40 years ago, in his shop in Syracuse. Having worked on steam engines of the Corliss type, I asked how he could run without a stuffing box on the valve stem. His answer was typical, "I make the bushing so long the steam gets tired before it gets through."

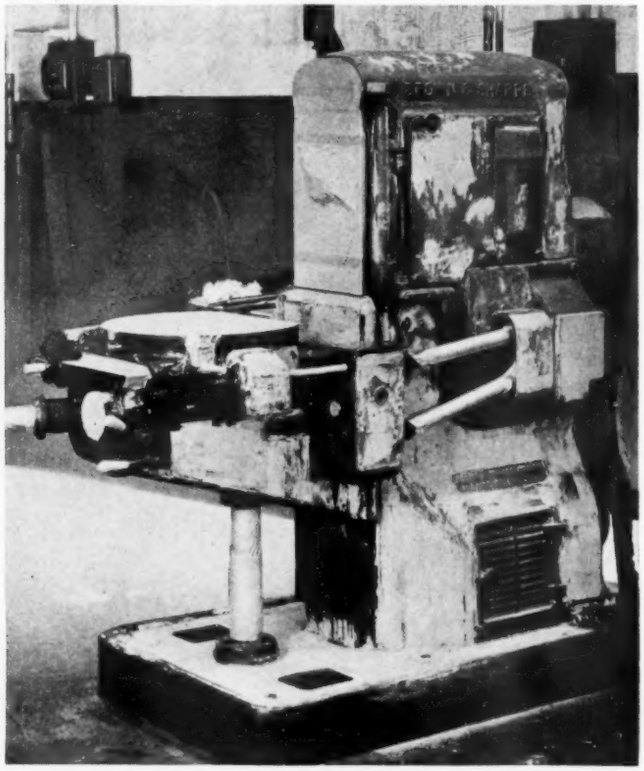
Industry needs tape

By E. J. TANGERMAN

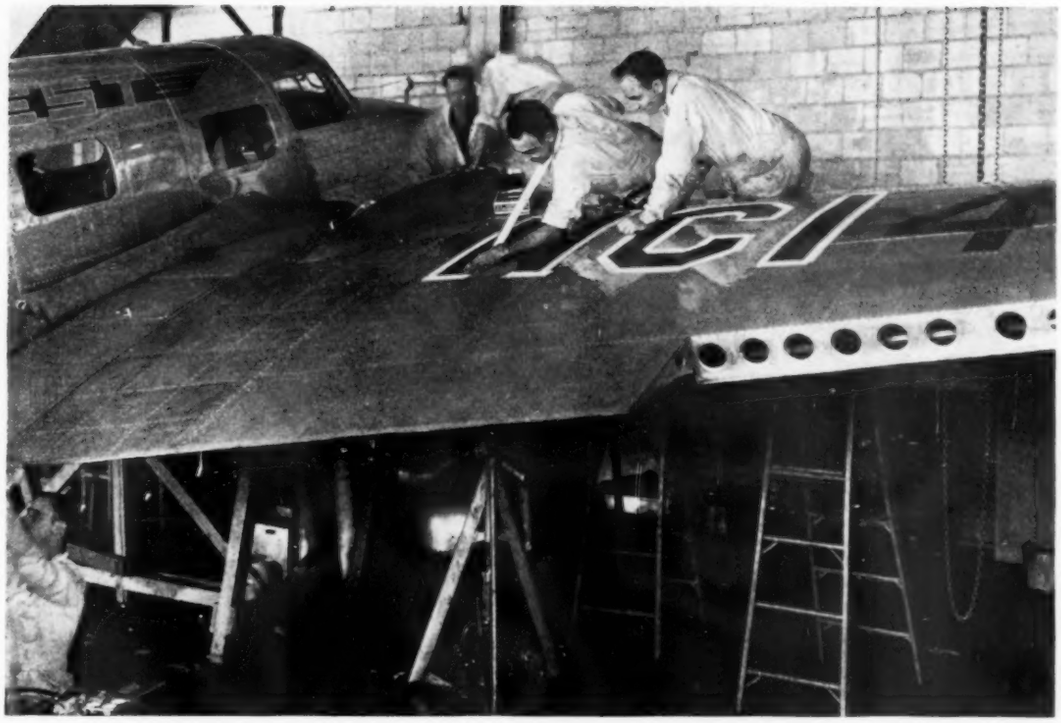
Not red tape, of course, but 50 other varieties that mask, hold and protect metal parts

DURING THE past couple of years, adhesive tape has come out of the plant first-aid room and is finding uses in dozens of processes. Over 50 distinct types, varying widely in backing, tensile strength and adhesiveness, are available. They are used for masking, protecting, holding, trimming, wrapping, insulating, sealing, and identifying. Stock tapes come in 60-yard rolls in widths of ¼ to 3 in. Backings vary to suit the job, including various cloths, papers, cellulose fibre, and rubber. Commonest are the masking tapes, with plain or crepe-paper backs, used to define the edge of a painted area and to protect areas not to be painted. The crepe-paper types can be "pulled" into any desired shape, as for example around the curve of an automobile windshield corner, or over the bezel and lens of a tail-light. The cloth-backed tapes provide greater tensile strength and wearing qualities, while the rubber-backed ones mask against sandblast or grit-blast, and thus permit blast-etching of designs, numerals, etc., on polished metal surfaces. Plain-backed paper tapes are now familiar in drafting rooms also for holding drawings and tracing paper, replacing thumb-tacks. It can also be used for outlining or masking-out sections of tracings before blueprinting. Cloth-backed tapes with high dielectric properties are available for electrical insulating, and other cloth-backed types for holding enameled or painted elements (as on an oven door) during shipping, and for sealing shipping containers against air. Typical applications are shown in these five photographs, furnished through the courtesy of Minnesota Mining & Mfg. Company.

Here used as a corner guide and protector in buffing a metal finish, masking tape is similarly applied for masking against spraying and for striping. It can be cut to any special shape (which, if carefully removed, can be used over and over again), and the crepe-paper-backed types can be made to follow any contour, as around the lens and plated trim on a headlight, along the edge of a trimming strip, window pane, or panel, as well as for special designs such as trademarks

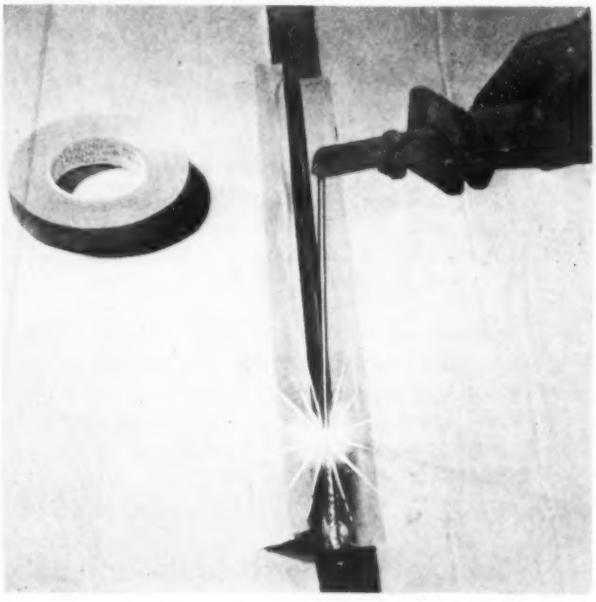


Rough surfaces of this milling-machine base have been filled, and machined surfaces are covered with masking tape in preparation for painting. Here, the machine face is protected with masking paper held in place by cellulose tape, while regular masking tape, cut to shape, serves elsewhere. These masks can be removed after painting without staining or gumming the finished surfaces. Similar taping is later done to hold padding and protective material over dials, handles, etc., during shipping, as well as to prevent rusting, or scratching from dust



Aircraft and automobile plants were among the first users of industrial adhesive tapes—for every part of the job from insulating small coils to trimming upholstered interiors in contrasting colors. Here wing markings are being masked before spraying. The side of the fuselage has already been similarly stencilled. The tape sticks so closely that sprayed lines are sharp and even narrow stripes can be masked

Protection during processing is often a complicated problem. Here, two strips of tape hold masking paper aprons to prevent burning of stainless-steel surfaces from spatter during welding. Tape is similarly used to protect enameled surfaces of a refrigerator shell against burning from hot chips when door-hinge holes are drilled



Small parts have a way of becoming lost in shipment. Here a turn of masking tape holds a key securely in its keyway, and more masking tape will be applied to protect both splines and threaded end. Similar methods are used for holding spare bolts or nuts to an assembly, for holding doors (particularly with finished surfaces—as on a porcelain-enameled stove) closed during shipment. There are also double-faced types for holding small parts while painting or blasting, and these, as well as single-faced types, can be obtained which will withstand even sprayed water or drying-oven temperatures

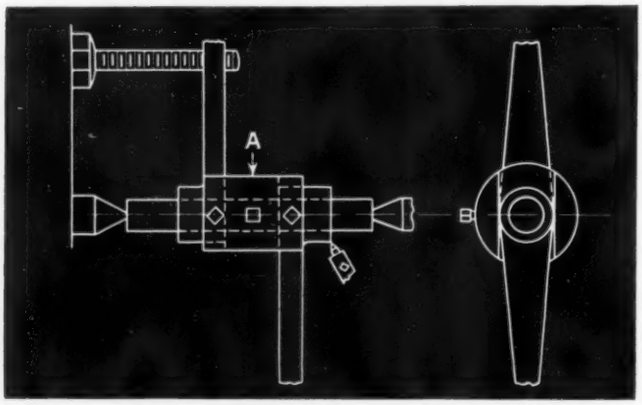
IDEAS FROM PRACTICAL MEN

Slotted Sleeve on Mandrel Holds Two Pieces

By H. MOORE
Leeds, England

The hubs of a large quantity of levers had to be turned and faced after they were bored. To do this a sleeve was slotted at the ends and was made to fit a mandrel of the same diameter as that of the bores in the lever hubs, permitting two levers to be mounted at one time, as indicated in the sketch. The slotted sleeve *A* was held on the mandrel by a setscrew and two other setscrews secured the levers in the slots in the sleeve.

This arrangement made higher rotative speed possible because the work was balanced. It also made the use of a dog unnecessary. After the hub of one lever had been finished, the mandrel was turned end for end, bringing the second lever into position and eliminating the necessity for changing or resetting the tool in the toolpost.

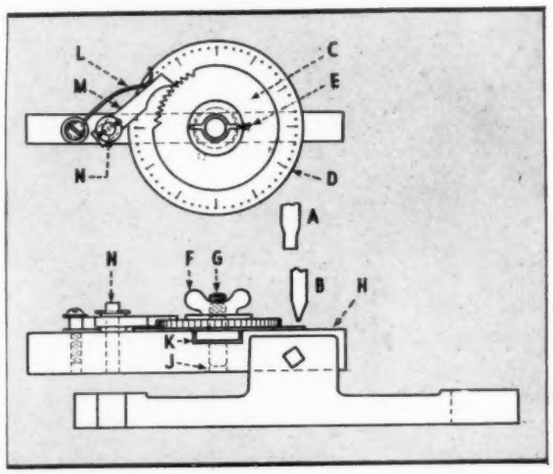


A sleeve slotted at both ends and mounted on a mandrel of the same diameter as that of the bores in the work held two levers at one time, balancing the work at high rotative speeds

Indexing Fixture Speeds Calibration of Dials

By ARAN AGHAZARIAN

We recently had to make a small quantity of clock dials on which 60 divisions were required. They were put through in a minimum of time with the aid of the illustrated indexing fixture operated by a foot press. The company's product being clocks, I was able to adapt a spare pawl, and a 60-tooth ratchet for the tool. The marking punches *A* and *B* were obtained from the toolroom.



This pawl-operated indexing fixture, operated by a foot press, served to stamp 60 division on a small order of clock dials

In operation, the ratchet *C* is located on the dial through one of the three fastening holes in the dial *D* by the stud *E* in the ratchet. The dial and ratchet are clamped together by wing nut *F* and shouldered stud *G*.

The stud *G* pivots this assembly on bar *H* through reamed hole *J*. The recess *K* in the bar is clearance for the shouldered stud *G*. Flat spring *L* backs up the pawl *M* which pivots between two washers on stud *N*. The entire assembly is mounted on a standard slotted-type die shoe. Punch *B* is first used to put the small impressions on the dials. Punch *A* is then substituted and the dashes are made at every fifth indexing point.

Riveters Clamp Plates To Be Shape-Cut

By W. J. TANGERMAN

Some time ago, we began to shape from scrap the blanks for pressing freight-car parts, such as hopper-car doors. We found the operation so economical that we have expanded it to the cutting of somewhat more elaborate blanks from new stock. However, we ran into some difficulty in the shape-cutting of packs of scrap plates, because many of them were bent slightly.

The obvious answer was to use some form of pressure clamp. As we cut twelve $\frac{1}{4}$-in. plates at once, a hand clamp was not practical, so we planned some sort of pneumatic device. The lowest bid for making two such clamps to our order was $7,000, but we solved the problem for less than 10 per cent of this cost by purchasing two second-hand 50-ton bull rivet-

ers for $250 each. With flat dies in place of the conventional cup dies, they make very effective and readily removable clamps, and have solved our oxyacetylene shape-cutting problem completely.

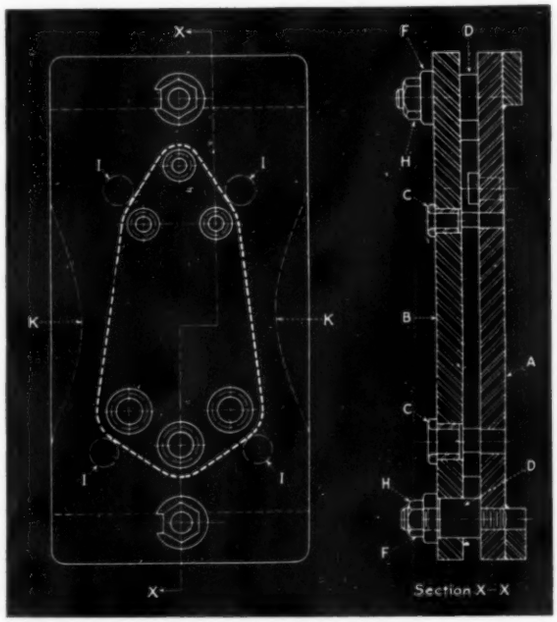
Drill Jig for Small Production

By WILLIAM B. GREENER

The jig illustrated was designed for drilling six holes in aluminum plates indicated by heavy dashed lines in the plan view of the jig. Since the quantity of plates to be drilled was small, the jig was made as cheaply as possible.

Essentially the jig consists of the baseplate *A*; the bushing plate *B*, both of which are cold-rolled steel of commercial width and thickness; the bushings *C*; the studs *D* for locating the bushing plate; the C-washers *F*; the hex nuts *H* for clamping the bushing plate on the work: and the guide pins *I* for locating the work. Square pieces of cold-rolled steel are welded to the underside of the baseplate to serve as feet, and the baseplate is cut away at *K* on both sides to allow finger room for easy removal of the bushing plate.

In operation, with the jig open, the work is placed on the baseplate, being located by the guide pins, and the bushing plate is placed over the studs. The C-washers are then slipped into place and the nuts are tightened, holding the work securely in place. After the holes have been drilled the nuts are backed off slightly, the C-washers are slipped out and the jig plate is lifted off, the holes for the studs being large enough to permit the plate to be lifted off over the nuts.



Work to be drilled in small-quantity production will not warrant making elaborate jigs. They must be made as cheaply as possible consistent with the accuracy required

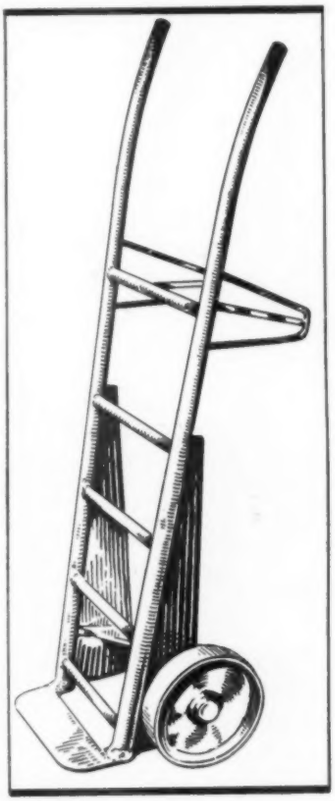
An All-Welded Hand Truck From Pipe and Plate

By ARTHUR HAVENS

Welders often make ingenious shop accessories. Take the illustrated all-welded hand truck, for instance, in which a number of novel ideas are incorporated. The handles are 5 ft. lengths of 1-in. pipe, bent slightly about 10 in. from the top end. The welder laid them on a bench 14 in. apart at the bottom and 20 in. apart at the top. Five cross pieces of ½-in. pipe were welded in at conveniently spaced intervals. The nose of the truck is simply a piece of ½x2 in. steel drawn down on one side to a sharp edge; this is welded to the bottom of the handles. Pieces of ¼-in. plate were welded to the back side of the handles to stiffen them and give the distance for wheel clearance.

Now the problem of wheels faced the welder. He cut some disks from ⅜-in. plate 9 in. in diameter and rolled ½x2 in. flat steel for tires. He cut 3x4 in. tubing into 2 in. lengths for the hubs. These were bored to take second-hand ball bearings. He welded the whole assembly into very novel wheels — two bearings to each wheel. A piece of 1¼-in. staybolt iron was used for an axle. A ¼-in. hole was drilled in the center of each bearing surface, through to the center of the staybolt. Grease cups were welded into the ends of the hollow-staybolt axles.

The wheels and axles were assembled, a washer being welded on each end to hold the wheels in place. The frame of the truck was placed on the bench in its normal standing position, and after the wheel and axle assembly was placed in position, it was welded to the frame. Two ½-in. U-irons welded to the handles act as rests.



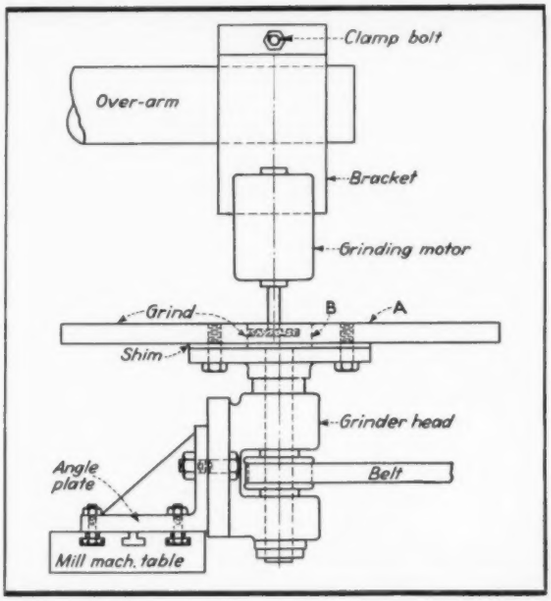
The welder who made this all-welded hand truck from scrap pipe and plate worked for a railroad in receivership. Wooden hand trucks unfit for further use were replaced at minimum cost

Grinding Large Work on a Milling Machine

By C. W. HINMAN

Recently we had a quantity of large pieces *A*, to be ground in hole *B*. The work was too large to be ground by swinging in a lathe, which had been our usual practice. The fixture illustrated was arranged to grind the holes on a milling machine.

A grinding motor was attached on a bracket, and



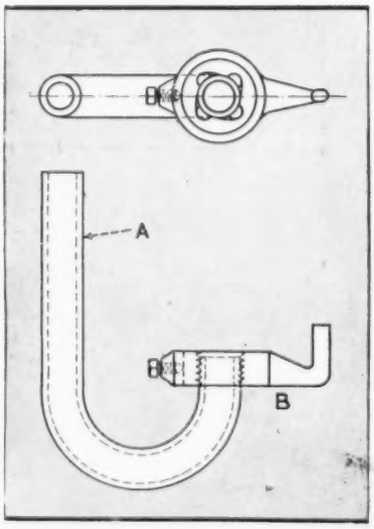
Resourceful application of grinding equipment found in most small shops permitted use of a milling machine for grinding a hole in a plate

the bracket was then clamped on the over-arm of the machine, with the motor in a vertical position. An angle plate, secured on the table of the machine, was used for mounting a belt-driven grinder head, so that the work could be revolved horizontally, as shown.

By using the lateral and vertical feeds provided with the machine, no difficulties were experienced in grinding the hole. It will be observed that this fixture could be used for face grinding the work if necessary.

When a Lathe Dog Served As A Die Holder

By C. F. FITZ



A round split die clamped in a lathe dog was used to rethread bent and plated brass pipes when the threads were cut oversize

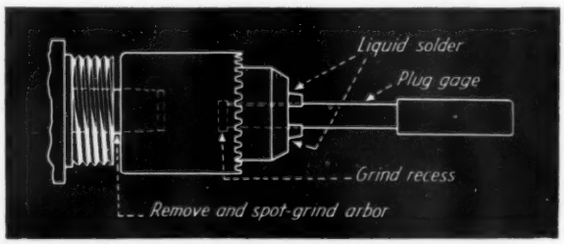
We had to make a number of brass pipes threaded and bent as shown at *A* in the drawing. They were then plated. Upon return from the plating department we found that the thickness of the plating was much more than we had allowed for and that the fittings would not fit the pipes. Since the nature of the fittings was such that we could not retap them, we were required to recut the threads.

We took a round split die of the required size and clamped it in a lathe dog as shown at *B* and rethreaded the pipes in the usual manner.

One Way to True Jaws of Small Drill Chucks

By BERNARD T. COOK

Drill chucks receive more than their share of abuse and for this reason should be reconditioned periodically. I recently trued a dozen chucks as follows: First, I removed and spot-ground all arbors to eliminate burrs and scratches and replaced the arbors in their respective bodies. Using $\frac{3}{8}$-, $\frac{11}{16}$-, and $\frac{7}{8}$-in. plug gages for $\frac{1}{2}$-, $\frac{3}{4}$-, and 1-in. chucks, respectively, the jaws were lightly closed on the gage and locked to the body with liquid solder. The solder hardens in a few minutes and after removing the plug, a recess about 0.010 in. deep is ground at the extreme back end of the jaws. The latter are then carefully ground concentric. The diameter of the internal grinding wheel should be approximately the same as that of the gage. The solder is easily scraped off once the operation is completed.

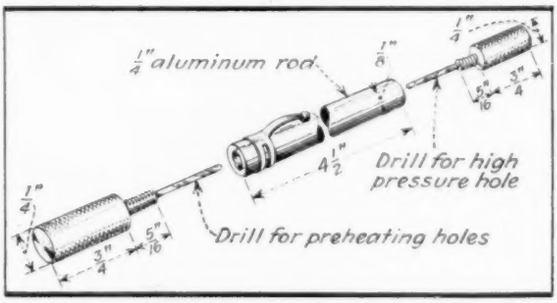


Drill-chuck jaws, centered on plug gages, can be soldered in position preparatory to grinding them concentric with the spindle

Pocket Holder for Cutting-Nozzle Drills

By A. H. CARROLL

Recently, I noticed in the pocket of a welding supervisor a neat-looking rig that resembled a pencil. Upon examination, the ends of the rig unscrewed and to them were soldered drills, just the proper size for cleaning clogged holes in oxyacetylene cutting nozzles. Carrying the drills in this convenient manner always keeps them handy and saves many trips to a work bench or tool box just when it is most aggravating to leave a job.



This $\frac{1}{4}$ in. aluminum rod with pencil clip attached has two threaded ends to which are soldered drills for cleaning holes in flame-cutting nozzles. It saves many trips to a tool box when the tips clog with flame-cut metal

Diamonds for Truing Grinding Wheels

BY LEO GLUCK

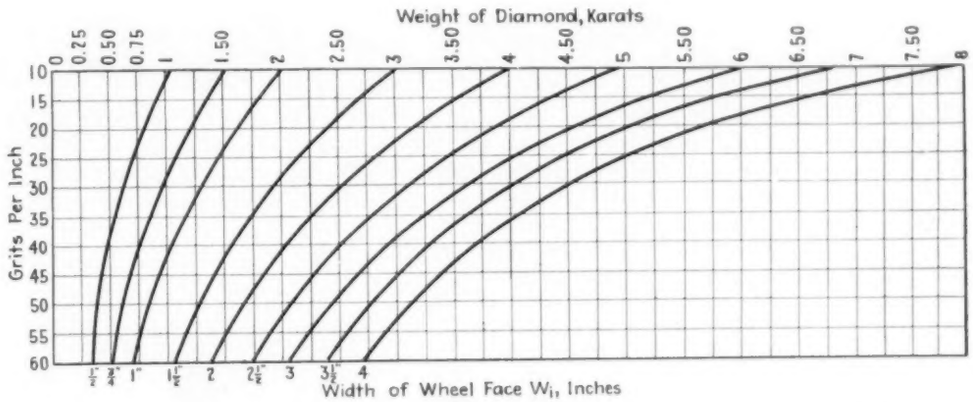
THE SIZE of grinding wheel grits and the width of the wheel face are the prime factors which control the weight of industrial diamonds used for truing the wheel. The required weight of the diamond increases in geometric ratio with the coarseness of the grits and directly with the face width of the wheel; also, with the number of wheel dressings which are required.

The unit weight of diamonds is the metric karat of 200 milligrams. The unit cost of the diamond increases in geometric ratio with the weight, while its resistance to abrasion is directly proportional to its weight. Therefore, for every grinding wheel or group of wheels there is an economic diamond size for truing operations. Selection of such diamond sizes can be made from either the table or drawing. Tabulated values, as well as those used in drawing the curves, were obtained by applying the following emperical formulas:

$$K = \frac{2400\ W_i}{[(N_i + 60)/2]^2}$$

$$K = \frac{945\ W_c}{[(2.54N_c + 60)/2]^2}$$

where K = diamond weight in karats; W_i and W_c = face width of grinding wheel in inches and centimeters respectively; and N_i and N_c = number of grits per inch and centimeter, respectively.



Knowing the face width of the grinding wheel and the grits per inch, the most economical diamond size for truing operations can be obtained from this chart

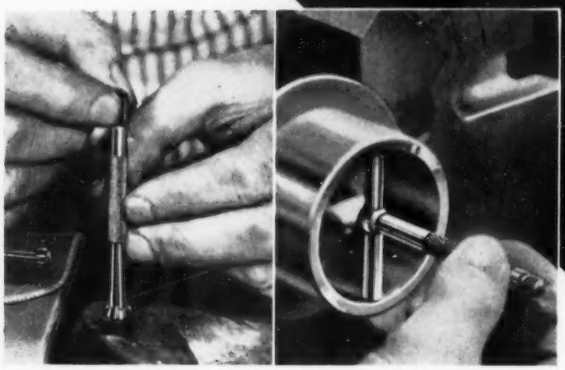
ECONOMIC DIAMOND WEIGHTS FOR TRUING GRINDING WHEELS

Grit No.	Grits per cm., N_c	Grits per in., N_i	Width of grinding wheel W_i, inches: 1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4
			Width of grinding wheel W_c, centimeters: 0.64	1.27	1.91	2.54	3.18	3.81	4.45	5.08	5.71	6.35	6.99	7.62	8.26	8.89	9.53	10.16
			Diamond weights, karats															
4	3.94	10	0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92	4.41	4.90	5.39	5.88	6.37	6.86	7.35	7.84
6	5.91	15	0.43	0.86	1.29	1.71	2.14	2.56	3.00	3.42	3.85	4.28	4.70	5.12	5.55	6.00	6.41	6.84
8	7.87	20	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75	4.10	4.50	4.88	5.25	5.63	6.00
10	9.84	25	0.34	0.67	1.00	1.33	1.67	2.00	2.33	2.66	3.00	3.33	3.66	4.00	4.33	4.66	5.00	5.32
12	11.61	30	0.30	0.60	0.90	1.19	1.50	1.79	2.09	2.38	2.68	3.00	3.28	3.57	3.87	4.17	4.50	4.76
14	13.78	35	0.27	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18	3.44	3.71	3.97	4.24
16	15.75	40	0.24	0.48	0.72	0.96	1.20	1.44	1.68	1.92	2.16	2.40	2.64	2.88	3.12	3.36	3.60	3.84
18	17.72	45	0.22	0.44	0.66	0.87	1.09	1.31	1.53	1.74	1.96	2.18	2.40	2.61	2.83	3.05	3.27	3.48
20	19.69	50	0.20	0.40	0.60	0.79	1.00	1.19	1.39	1.58	1.78	2.00	2.18	2.37	2.57	2.77	3.00	3.16
22	21.65	55	0.19	0.37	0.55	0.73	0.92	1.10	1.28	1.46	1.65	1.83	2.01	2.19	2.38	2.56	2.74	2.92
24	23.62	60	0.17	0.33	0.50	0.67	0.84	1.00	1.17	1.34	1.50	1.68	1.83	2.00	2.18	2.35	2.50	2.68

Note.—Diamond weights for wheel sizes other than those given can be interpolated from the table.

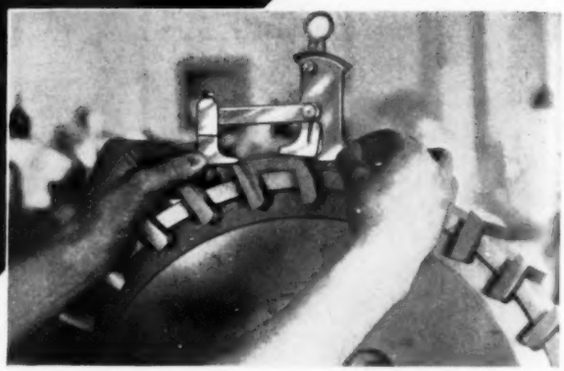
STARRETT TOOLS

ARE YOU DOING THESE JOBS THE HARD WAY?



HERE'S AN EASY WAY TO HANDLE INSIDE MEASUREMENTS — ⅛ TO 6 INCHES

On work involving a number of holes, slots or grooves of different sizes, or when duplicate work must be checked for standard hole sizes, these Starrett Gages provide a quick, reliable solution. Small Hole Gages No. 829 take care of the small stuff from ⅛ to ½ inch; Telescoping Gages No. 229 handle the rest up to 6 inches. Both types can be set to a given size and used as plug gages or expanded to "feel" for close or loose fits and miked for size.



THE RIGHT WAY TO CHECK FOR CORRECT CUTTER CLEARANCE

On any cutter from 2″ to 30″ or more in diameter — end, spiral, helix, or inserted tooth — Starrett Cutter Clearance Gage No. 459 checks clearances directly and *accurately* in degrees. No need to remove cutter from grinding arbor, no fooling with protractors, etc. — saves grinding time, makes cutter work better, last longer.

GEAR TOOTH CALIPER No. 456 SAVES COMPLICATED FIGURING ON GEAR WORK

A "must" tool for work on gear teeth, gear cutters, hobs, etc. Measures both chordal thickness and addendum simultaneously — reads direct in thousandths of an inch (available also Metric by 1/50 mm.) and may be had in 20-2 or 10-1 diametral pitch.

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Among the 3000 tools shown in up-to-date Starrett Catalog No. 26C are scores of new tools or familiar tools with important refinements and improvements. Look them over for ways to do more and better work. Write for a free copy.

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AVAILABLE THROUGH YOUR FAVORITE SUPPLY HOUSE

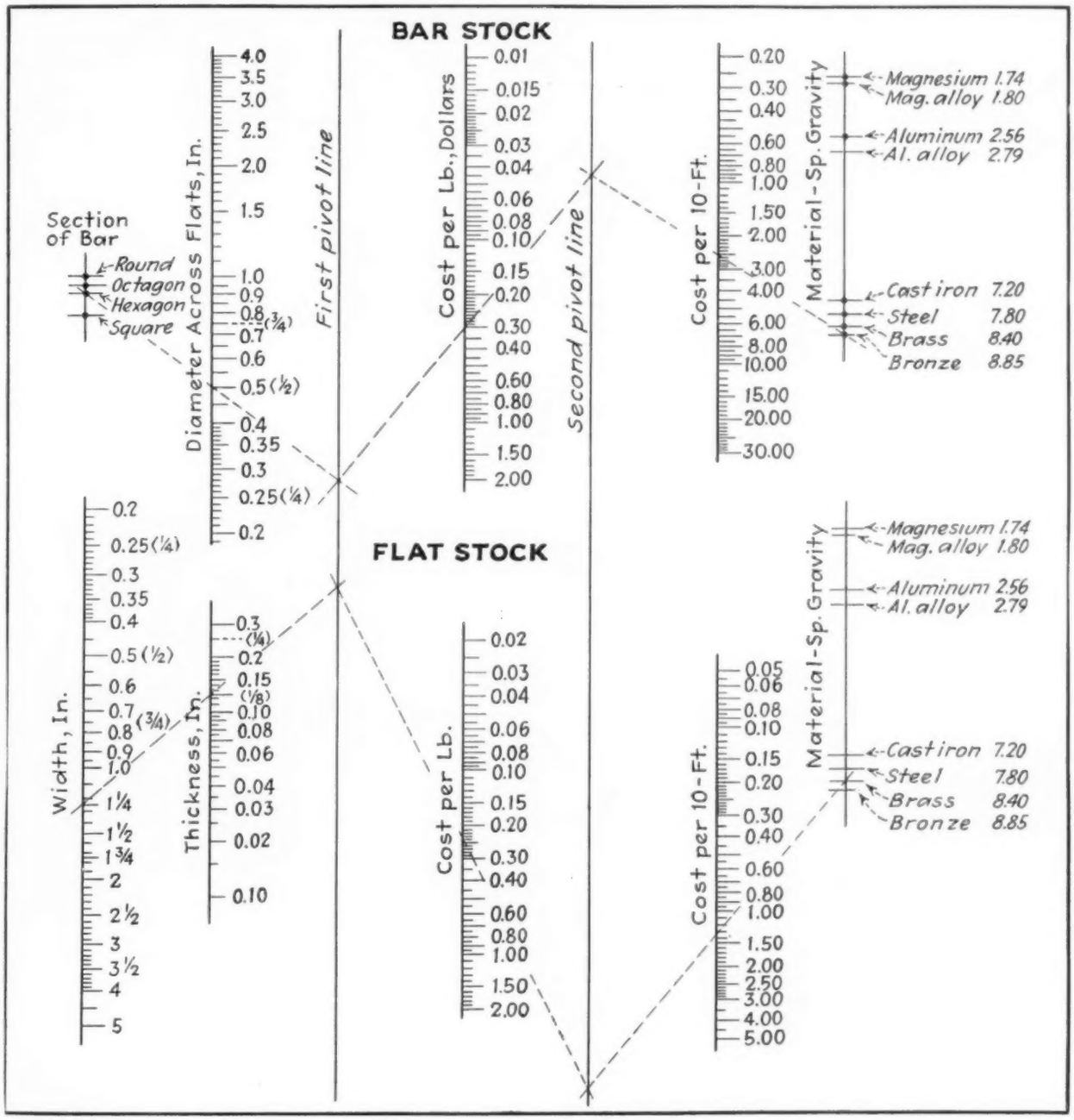
AMERICAN MACHINIST REFERENCE BOOK SHEET

Charts for Cost of Flat and Bar Stock

BY LOUIS de L. BERG

THESE CHARTS are for determining the cost of 10-ft. lengths of flat and bar stock. In using the chart for bar stock, pass a straight line through the known section and diameter until it intersects the first pivot line. The line is continued from the first pivot line, through the cost pound of the material to the second pivot line. A line from the last point to the material from which the stock is made will give cost of bar in 10-ft. lengths.

For the examples shown by dashed lines on the chart, the cost per 10 ft. of ½-in. bronze hexagonal stock, quoted at 30¢ per lb., will be $2.50. A 10-ft. piece of flat 1¼x⅛-in. brass, quoted at 25¢ per lb., will cost $1.30.



FAST AND ACCURATE

Profitable returns are assured by using NEW BRITAIN Automatics because of NEW BRITAIN'S built-in features. There is speed to meet production demands of the greatest volume, power and rigidity for the toughest cut, and precision to meet conditions requiring closest tolerances.

NEW BRITAIN-GRIDLEY MACHINE DIVISION

THE NEW BRITAIN MACHINE CO.
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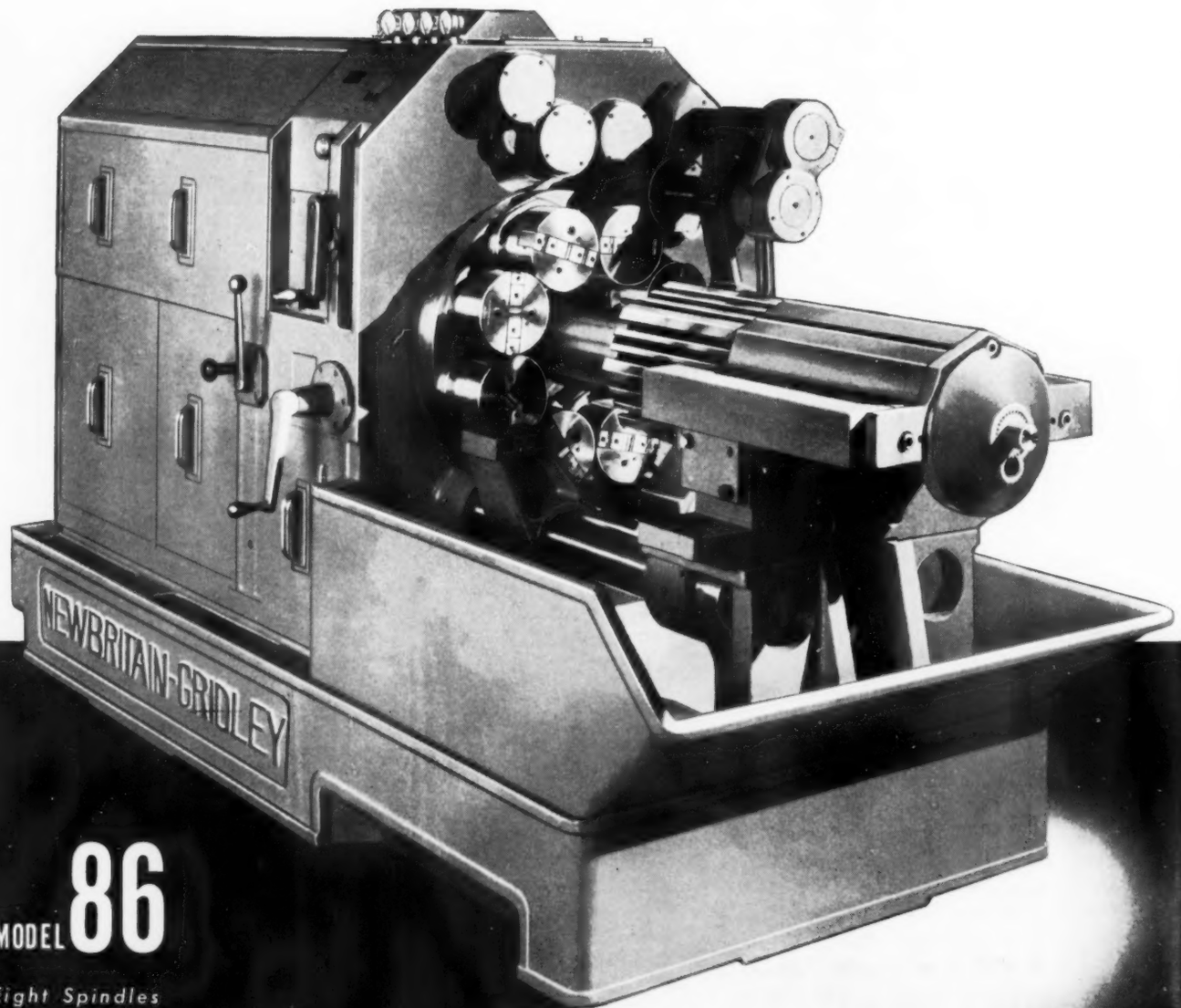


MODEL 86

Eight Spindles
6¾ - inch chucks

A complete line of Chuckers — Four, Six and Eight Spindles to 10¼" Capacity
Also a complete line of Screw Machines—Four and Six Spindles tc 2¼" Capacity

Wanted: "Trained Brains"

GENERAL SHERMAN MILES, assistant chief of staff of the United States Army, is speaking:

"We draw a somewhat false lesson when we say that this is the age of mechanized war. The machine does not think; even superiority in numbers of weapons promises no success unless they are handled by trained brains."

That is a plea for the training of soldiers—of plane pilots, of tank operators, of men who can fire anti-aircraft guns with speed and dexterity.

A similar plea should be made in connection with industry's part in armament production. Robots cannot run factories. They must be manned by operators familiar with their jobs.

Shortage of skilled labor, which the National Industrial Conference Board's survey shows is the most serious bottleneck in the armament program, is no sudden discovery on the part of those in Washington responsible for industrial mobilization. They have known it for months, or longer.

But they haven't been able to do more than issue milk-toast statements for fear that the C.I.O. and A.F.L. would kick up a fuss. When you start advocating wholesale training of men, you step heavily on the toes of organized labor!

And when it comes to the difficulties imposed by unions on the training of men, just thumb back to page 577 and read "Still Bewildered."

Anyway, the country finally is aroused to the need for training. A number of federal agencies are at work, cooperating with State and local groups. Individual companies are setting up apprentice systems and learner classes. That is all to the good.

What must be watched carefully is that the W.P.A., the N.Y.A., the C.C.C. and other agencies involved don't work at cross purposes. So far as we can see, there isn't much coordination. If there is any, it has been successfully hidden.

The government should make it easy instead of hard for youths and men to enroll for training. A young friend of ours wrote five weeks ago to the Army Air Corps that he wanted to become a pilot. To date he has had no acknowledgment from anybody. A newspaper reporter in Washington wandered around from one government agency to another to see what he should do if he wanted to take a machinist's training course. After three hours of being shunted around, he still was unable to secure any information.

One other point. Youngsters may be the most promising talent on which to draw for new recruits for metal-working plants, but industrialists will make a serious blunder if they pass by men 35 to 40, and possibly older. If the man of middle age is shunned or discriminated against, he will feel himself an outcast. His family and friends will be bitter too. Agitation for the government to do something to right a wrong will spring up. And a new law probably will be saddled on industry.

How much better it will be if industry will make a place within its ranks for a proportionate number of older men qualified to take training instead of confining its trainees to youngsters. In fact, some companies already are doing that. More should take up with the idea.

Burnham Finney

GAGING BUSINESS

Wright and Chrysler figure on machines for defense production. British ship U. S. machine tools to Canada. Allison is building eight engines a day. U. S. Steel secures huge munitions order

Metal-working plants face the most active period in history because of their vital role in the Defense Program. Plant expansion and retooling on a vast scale are planned and, in many cases, already under way. A skilled labor shortage is the most worrisome problem. The country is being scoured for good tool and die makers, all-round machinists, welders, pattern makers, operators of certain types of machine tools, and mechanical draftsmen.

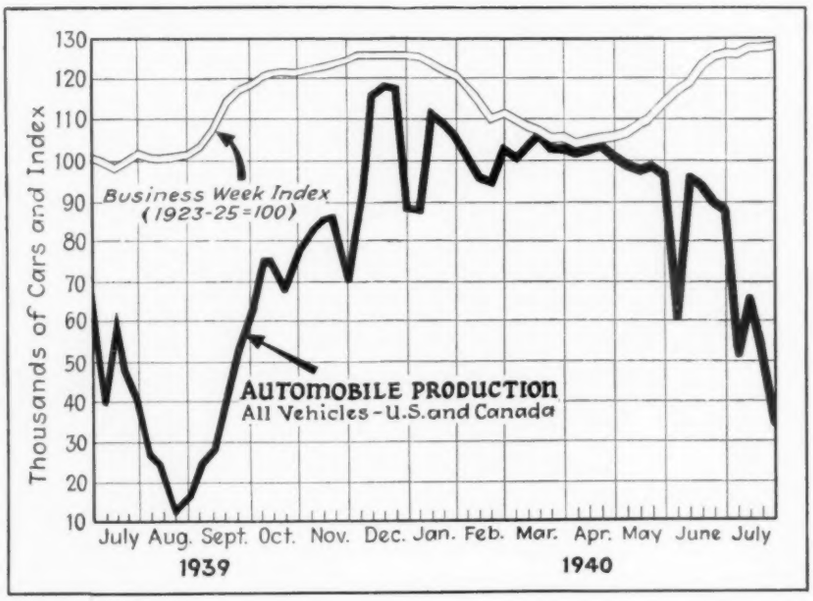
Machine Tools—New business has been large. Most of it, aside from British orders, is for the Defense Program. Pending inquiries give a clue to the tremendous bookings the next few months. Wright Aeronautical is starting to figure on equipment for its new gigantic aircraft engine plant near Cincinnati. Chrysler has been asking for prices and delivery dates on equipment for high-speed light tank production, while Packard shortly will be in the market for machinery for its Rolls Royce job. After months of inaction, the Canadian market is busy. McKinnon Industries, John Inglis, Ford of Canada and a number of plants in and around Toronto and Montreal are taking on munitions contracts. Many machine tools required for this work are being sent to Canada instead of to England by the British Purchasing Commission as U. S. builders make deliveries on orders. The British also are assigning American machine tools to Australia where a munitions industry is being built up as rapidly as possible. The Netherlands East Indies, erecting armament plants to supply their own defense needs, are purchasing machine tools here. Manufacture of big machine tools for the Navy is being accelerated by resort to several practices, such as negotiated contracts, inspection of the machines on the floor of the user instead of in the builder's plants, and pooling of the facilities of the builders. The industry has increased its plant capacity 25 per cent since last September, according to a reliable check-up. Reports are heard in the industry of serious delays in securing licenses for machines destined for export. It is said authoritatively, however, that less than five per cent of the export license applications are being disallowed.

Railroad Equipment—Orders for almost 5,000 freight cars have been placed the past two weeks. Illinois Central has contracted for 3,000 cars, buying 1,000 each from Pullman-Standard and General American Transportation and 500 each from American Car & Foundry and Mount Vernon Car. Norfolk and Western will take 500 cars from Ralston Steel Car. Five of thirteen diesel-electric switching locomotives for Reading went to Baldwin. The Baltimore & Ohio has purchased 25 diesel-electric switchers from Electro-Motive Corp. Union Pacific is in the market for 16 steam locomotives. In addition to its locomotive-building business the Electro-Motive Corp. is rough machining forgings for Allison Aircraft engines.

Steel—Though the industry is running at over 90 per cent, full effect of defense orders will not be felt for months. No one knows what the ultimate tonnage will be. Companies already are conscious of the "push" for alloy steels, and are installing more electric melting furnaces to increase capacity for defense purposes. It is believed in steel circles that present facilities, rounded out a bit here and there, will be adequate without building many new plants. Steps are being taken to expand armor plate producing and fabricating capacities.

Aircraft—Agreement of airplane builders to sign government contracts immediately instead of waiting for plant write-off legislation to be passed has cleared the road for huge plant expansions. Notable among the increases will be those of Douglas and Glen Martin. Biggest bottleneck still is in aircraft engine production. The RFC has approved a loan of $92,000,000 to Wright Aeronautical to build a plant near Cincinnati to turn out 12,000 motors a year. Allison is making six to eight liquid-cooled engines a day and expects within 30 to 60 days to be up to its present plant capacity of 20 motors a day. Any further increase of Allison's capacity is contingent on new government contracts. Ford is reported considering manufacture of the French Hispana-Suiza motor. U. S. plane production in August will be 900 to 1,000 planes.

Munitions—The United States Steel Corp. has been awarded a contract for $27,583,000 for projectiles, explosive and ammunition parts which will be filled by its subsidiary, National Tube Co. Large orders have been placed by the Army for such products as shell, cartridge cases, gun carriages, shell forgings and machine guns. It will take months, however, for industry to tool up for many of these jobs. Production will not be under way on a sizable scale until the early part of 1941.



United States to Take Training Planes While Great Britain Gets Combat Ships

Solution seen to aircraft allocation problem; shortage of liquid-cooled engines slows production of pursuit planes

WASHINGTON—Vast expansion of this country's air force, particularly as contemplated in the pending $5,000,000,000 appropriation, raises anew the problem of allocation of airplane production as between this country and Britain. Knudsen, of the defense commission, Morgenthau, and Purvis of the British Purchasing Commission have been holding a series of conferences on the subject. It is not publicly admitted, but the decision has been reached that most of the actual combat planes will still go abroad, while we will hang on to the training planes. This fits in with our present need, which is to train a big pilot force while capacity for big air fleets is built up. Of August production, 236 planes have been allocated to the British, while this country will take 396—largely trainers. Other countries will take 84, which includes deliveries to Norway going to swell the British air forces. Large commercial planes round out a scheduled 900-ship production for August—which might reach 1,000 with luck. Present plans contemplate that production will reach the 3,000-month level the middle of 1942.

Grandiloquent British announcements that they will be taking delivery here of 3,000 planes a month by next January are completely discounted here and assumed to be for home consumption. Purvis did ask Knudsen to estimate the plant investment that would be required to superimpose such a production on present schedules and was told that 38 factories would have to be built. It is estimated that this would cost in the neighborhood of $1,000,000,000. Chief significance of the British proposal is that it shows they are not going to ride along on U.S-stimulated plant expansion but will continue to put their own money into plants. Meanwhile, underwriting of their orders by big domestic appropriations simplifies their problems.

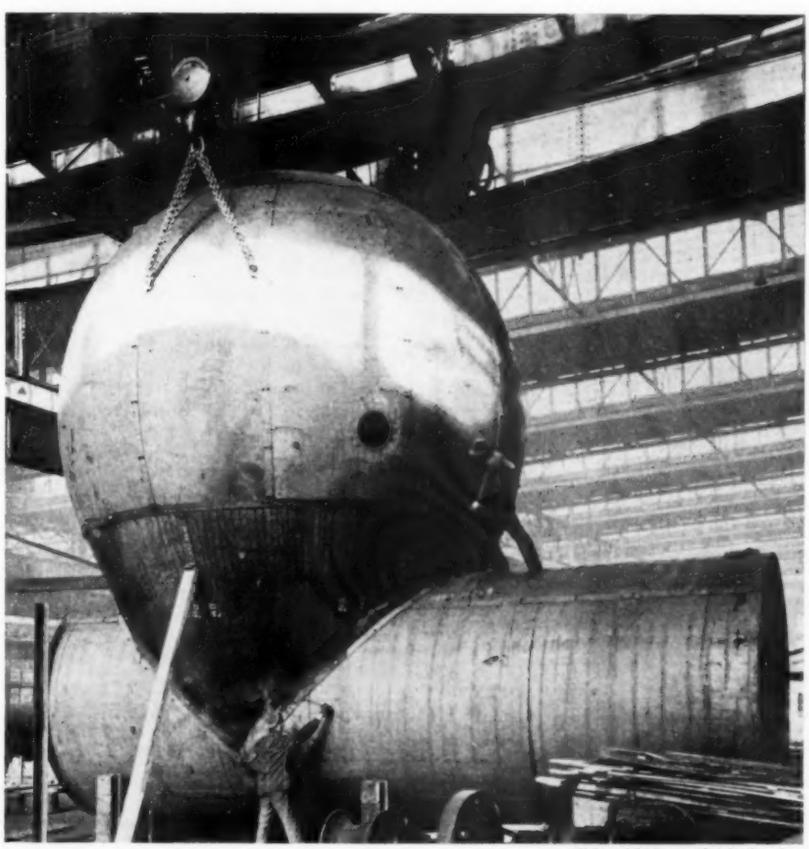
The vital problem of getting enough liquid-cooled engines to power pursuit airplanes is still troublesome. But through personnel changes, elimination of experimentation, and probably some liberalization of specifications it is hoped to improve the situation. July production of Allison engines is about 65, while it is hoped to turn out 130 in August and to reach 400 a month by November. The Rolls-Royce Packard will not be in production for at least ten months. Meanwhile Curtiss P-40s are standing in the yards waiting for engines.

FORD MAY BUILD FRENCH MOTOR

NEW YORK—Ford Motor Co. is reliably reported to be considering the manufacture at Dearborn of the Hispana-Suiza liquid-cooled aircraft engine. It is known that a Hispana-Suiza motor was recently brought to this country consigned to Ford and was hurriedly moved by truck from New York to Detroit. It is believed that this motor is now being closely studied by Ford officials. Ford, partly through its French organization, has had intimate relations with Hispana-Suiza for some time, and at one time was believed preparing to build the Hispana-Suiza motor at its French plant.

Johnson Resignation Not Result Of Petty Policy Differences

WASHINGTON—Resignation of Louis Johnson as assistant secretary of war is seen here as primarily a matter of personalities. No important policy differences are thought to have existed. Johnson, an advocate of business control of defense, was unpopular with the left wing, but the New Dealers are in abeyance for the present, as regards defense, and could hardly have forced him out. Point is that Johnson, an ambitious and energetic man, had been passed over twice for the secretaryship. First time this happened it resulted in a feud between him and Woodring that split the department into cliques for years. After Woodring quit, numbers of officers identified as Woodring men had swung over to the assistant secretary. Continuation of Johnson would have resulted in an impossible situation for Secretary Stimson. Roosevelt's offer of a post on his personal staff was doubtless sincere, but it is doubted that Johnson will accept.



Wilson Welder & Metals Co., Inc.

Arc Welding—*This novel appearing structure shows how far designers are able to go in arc welded fabrications involving complex assemblies of curved shapes. Eighteen pieces were required for the sphere while all plate material in the cylinders have a ⅜-inch wall thickness*

Buick Increases Capacity 15 Per Cent; Moves to Handle National Defense Work

DETROIT—Harlow H. Curtice, president and general manager of Buick, revealed that completion of a major expansion and retooling program will boost productive capacity to 1,500 cars per day, or 350,000 annually, against a capacity during the model run just ended of approximately 1,300 per day.

The expansion program will permit Buick to cope with increased market requirements for cars in 1941 and at the same time care for national defense needs. In connection with the latter, Mr. Curtice revealed that Buick engineers have been working with the army upon projects intended to adapt the valve-in-head motor to military uses. And other armament production has been considered. Arms manufacture would be collateral with the industry's duty to maintain normal operations and employment in automobile production.

Major construction projects completed for the 1941 season include construction of a large addition to the sheet metal plant and rearrangement of machinery, a new axle plant, removal of gear manufacture to a new building and a new layout for production of connecting rods.

Predicts 10 Per Cent Gain

Mr. Curtice expressed confidence in the business outlook, estimating 1941 as a probable 10 per cent increase for the industry. Buick output for the 1940 season consisted of 283,204 cars, an all-time high. More than 15,800 employees worked an average of 2,050 hours each. Employment for the changeover season his held consistently above 9,000, and the changeover to new model production will be one of the shortest on record. Buick will hold its press preview for new lines on August 13.

CANADIAN LATHE FIRM STARTED

VANCOUVER—A contract valued at $300,000 for 100 shell lathes has been awarded to a new company being organized at Vancouver, B. C., by the Federal Government. Six prominent Vancouver businessmen are backing the new venture. The company will not erect its own plant, but will distribute the lathe manufacture amongst a number of existing machine shops located in Vancouver.

The 100 shell-making lathes are to be ready within four months. It is also reported, although official confirmation is now lacking, that following construction of the lathe munition production will be started in Vancouver by the new company.

U. S. Government Contracts Awarded to Tool Makers

(Defense Contracts on Page 590j)

Contractor	Gov't Agency	Commodity	Amount
Swind Machinery Co., Philadelphia, Pa....	Navy	Power shear	$18,874
Lloyd & Arms, Inc., Philadelphia, Pa....	Navy	Honing machine, lathes	34,040
Hydraulic Press Mfg. Co., Mount Gilead, Ohio	War	Hydraulic press	17,310
National Acme Co., Cleveland, Ohio	War	Automatic machines	35,996
Vandyck Churchill Co., Philadelphia, Pa...	War	Milling machines	13,668
W. E. Shipley Machinery Co., Philadelphia, Pa	War	Shapers	10,639
Henry Prentiss & Co., New York, N. Y...	War	Grinding machine	10,435
Gisholt Machine Co., Madison, Wis.	War	Lathes	14,477
C. H. Gosiger Machinery Co., Dayton, Ohio	War	Lathes, drill presses	37,328
H. R. Kreuger & Co., Detroit, Mich	War	Reaming machine	14,623
Cyril Bath & Co., Cleveland, Ohio	Justice	Press brakes	11,475
Cincinnati Milling Machine Co., Cincinnati, Ohio	War	Milling machines	152,670
Toledo Machine & Tool Div., E. W. Bliss Co., Toledo, Ohio	War	Presses	21,651
Brown & Sharpe Mfg. Co., Providence, R. I.	War	Milling machines	94,351
G. A. Gray Co., Cincinnati, Ohio	War	Planer	21,040
Gleason Works, Rochester, N. Y.	War	Gear cutting machine	17,984
Kearney & Trecker Corp., Milwaukee, Wis.	War, Agriculture	Threading machines, Millers	64,859
Pratt & Whitney Div., Niles-Bement-Pont Co., Hartford, Conn	War	Toolroom machine	13,745
Monarch Machine Tool Co., Sidney, Ohio.	Navy	Lathes	54,681
E. A. Kinsey Co., Cincinnati, Ohio	Air Corps	Milling machines	25,917
New Britain-Gridley Machine Div., New Britain Machine Co., New Britain, Conn.	War	Chucking machine	77,880
Sundstrand Machine Tool Co., Rockford, Ill	War	Automatic machines	10,782
Bodine Corp., Bridgeport, Conn	War	Reaming machine	10,480
Steacy-Schmidt Mfg. Co., York, Pa	War	Crimping machines	12,150
Yates-American Machine Co., Beloit, Wis.	War	Borers	56,742
Norton Co., Worcester, Mass	War	Grinders	48,027
Seifreat-Elstad Machinery Co., Dayton, Ohio	War	Honing machines	258,632
H. R. Krueger & Co., Detroit, Mich	War	Broaching machine	15,095
Stedfast & Roulston, Inc., Boston, Mass...	War	Rebuilding machines	23,841

ALL IDEAS WELCOME

WASHINGTON—The scientist in his cellar laboratory comes into his own in the defense program. Harry Hopkins has appointed a National Inventors' Council, headed by Charles F. Kettering of G.M., to examine ideas on defense, screwball and otherwise, submitted by the civil population. Commissioner of Patents Conway P. Coe will maintain liaison between the council and the recently appointed Defense Research Committee.

Export License Exemptions Announced by State Dep't.

The Division of Controls of the Department of State, Washington, D. C., has indicated that export licenses are not required for the following items:

- All used or rebuilt machine tools of any description
- Pipe threading machines
- Metal cutting band saws
- Power driven hack saws
- Keyseating machines
- Disc grinding machines
- Car wheel & locomotive wheel presses
- Burring, Chamfering, Burnishing gear machines
- Planers—crank
- Bench power presses
- Saw sharpening machines
- Filing machines
- Pipe bending machines
- Thread chaser grinders
- Burnishing machines
- Tool & cutter grinders—universal and plain-hand feed
- Riveting machines
- Grinding machines—portable, with flexible shaft
- Centering machines
- Grinders—face milling cutter
- Arbor presses—hand, air and hydraulic
- Grinding machines—drill, tap, hob
- Nibbling machines
- Grinders—lathe tool
- Gear tapping machines
- Gear shaving machines
- Polishing machines
- Heat treating furnaces
- Foundry machines
- Portable tools driven by fractional horsepower motors or by compressed air
- Blocks, rolls, shears, small punches, if hand operated.
- Repair parts for machine tools other than important sub-assemblies, in quantities not sufficient to constitute a substantially complete metal working machine of the character mentioned by the President's proclamation of June 2nd, in unassembled form.

Warner & Swasey Plans to Offer Its Stock to Public

CLEVELAND — If stockholders approve August 20, the Warner & Swasey Co. will become a corporation with a substantial public ownership. The company will be recapitalized and a public market provided for its closely held securities.

The plant is to increase the common stock from an authorized 300,000 shares of $5 par value to 1,000,000 shares without par value and to change each share of $5 par value common stock into three new shares without par value. At present 248,245 shares of $5 par value common stock are outstanding.

The heirs or estates of Worcester Reed Warner and Ambrose Swasey, who founded the company, plan to dispose of a part of their holdings largely for tax reasons or for purposes of diversification. The company expects to register these shares of common stock and certain shares which the company may wish to sell with the Securities and Exchange Commission. The management feels it would be beneficial if outstanding shares were more widely distributed so as to establish a broader market for the company's securities. Stock distribution will be through a group headed by Smith Barney & Co.

Six per cent cumulative preferred stock, totaling 13,502 shares of $100 par value, will be retired, if the program goes through, either through redemption or through an exchange of common stock.

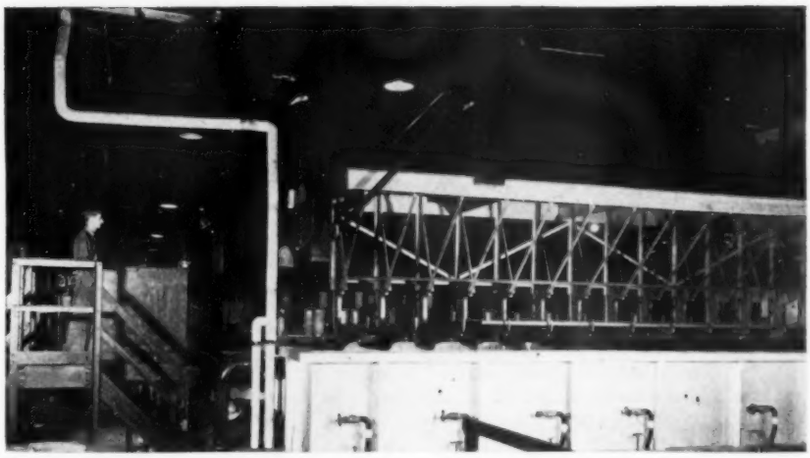
Charles J. Stilwell, president, and other senior officers identified with the company for more than 20 years will continue responsible for the management.

INDUSTRIAL TRAINING PROGRAM MEETS WITH CRITICISM ON DELAY

WASHINGTON—The much publicized plans for the training of thousands of men in the skilled trades are meeting many difficulties. Some observers indicate that the opposition to training in plants is not coming from labor as much as it is from industry. The latter simply cannot dilute productive processes by taking on trainees on the scope contemplated.

The National Youth Administration plans for vocational training in hand skills is making a concrete approach through the establishment of training shops to familiarize young men with factory work and prepare them to enter industry. Industrial experts may fit in as instructors in night-school training programs.

Meanwhile other observers indicate that the entire training program will take months to shake down to any sort of efficiency.



From Furnace to Tank—*A crane grapple delivers a load of bars to an 18,000 gallon quenching tank after being treated in a bell-type heat treating furnace. In the tank the bars are cooled to the required temperature before removal to a Brinell testing bed for physical tests*

Aircraft Companies Will Sign Defense Contracts, Profit Limitations Notwithstanding

WASHINGTON—To avoid defense production delays representatives of major aircraft companies, headed by Donald W. Douglas, have agreed to sign contracts immediately instead of holding them up until legislation regarding profit limitation and amortization rates is enacted. Plane manufacturers have been advocating a write-off in five to eight years of depreciation for tax purposes as a safeguard in plant expansion for defense.

"This action by the industry," says Mr. Douglas, "will cut much red tape while necessary laws are being passed and make possible immediate start toward the huge expansion so vitally needed. Manufacturers feel that speed and production are the paramount issues."

Plane makers have been in conference with the Army, Navy and Defense Advisory Commission. Recently the Treasury Department issued a statement approving the write-off in eight years of new factories and equipment designed solely for defense purposes. Congressional legislation will soon be introduced to permit amortization in five years.

Plane contracts cleared by the National Defense Advisory Commission include $900,378 for Cessna Aircraft, $2,074,070 for Ryan Aeronautical, $16,361,342 for Consolidated Aircraft, $993,844 for Fairchild Engine & Airplane, $7,562,834 for Aviation Mfg., $3,510,746 for Beech Aircraft, $5,713,389 for Stearman Aircraft, and $33,913,296 for Boeing Aircraft, and $1,859,880 for Spartan Aircraft. Plane engine contracts have been cleared in the following amounts: $1,488,272 for Wright Aeronautical, $5,489,308 for Ranger Aircraft, $1,541,448 for Lycoming Division of Aviation Mfg.

MORE DEFENSE CONTRACTS CLEARED

WASHINGTON — Army and Navy contracts amounting to $1,650,000,000 were cleared by the National Defense Advisory Commission's production division, under William S. Knudsen, from June 6 to July 17.

Among the contracts not already reported in AMERICAN MACHINIST are the following: $5,661,600 to the Springfield armory for Garand rifles, $4,573,628 to Sperry Gyroscope Co. for equipment, $7,700,000 to the Watervliet arsenal for artillery guns, $11,496,951 to American Car & Foundry Co. for tanks, $5,387,500 to White Motor Co. for scout cars, $877,723 to Auto Ordnance Corp. for rifles, $732,000 to R. Hoe & Co. for recoil systems for anti-aircraft guns, $1,757,083 to Vickers, Inc., for gun turret equipment, $1,797,536 to Northern Pump Co. for gun turret equipment, $16,055,415 to Picatinny arsenal for ammunition and bombs, $535,074 to Erie Forge Co. for breech house forgings, $549,500 to Crucible Steel Co. for gun barrel forgings.

TAKE ORDERS AT LOCAL OFFICES

WASHINGTON—There is no need for most manufacturers to go to Washington for orders. The Army and Navy will buy machinery and equipment through local procurement offices.

Canada Boosts Production of Munitions; Plants, Planes Receive Most Attention

MONTREAL—On the assumptions that Hitler's blitzkrieg will fail, that Britain will continue to control the sea and effectively blockade the continent—Canada's war efforts are being concentrated in two directions.

Firstly, to quickly produce as many essential war materials as possible and which are vital to Britain in repelling an invasion. Such materials include aircraft, anti-tank and anti-aircraft shells, and munitions of all kinds. To assure the rapid production of such war materials, government control is being exerted over machine tools, raw materials, transportation, and exports.

Secondly, To develop war industries, which will be able to produce vast quantities of chemicals, munitions, and armament of all classes for an offensive. In this connection total war contracts in Canada exceed $400,000,000 to date, and some observers indicate that new orders worth $200,000,000 are likely to be placed shortly. New commitments for capital outlays to provide facilities for Canadian production are expected from the British and Canadian governments.

The most recent plant commitments include the following: a $9,000,000 plant for the manufacture of chemicals; an $8,000,000 shell-filling plant to be managed by Canadian Car & Foundry Co.; and 13 plants to be built at a cost of $20,000,000 to $31,000,000.

Ford and General Motors are spending several million dollars in adding to existing plant capacity so that carriers for guns and other armament equipment may be produced. Plant additions (excluding entirely new plants) already financed by Britain and Canada will exceed $80,000,000 when completed.

The Canadian Pacific Ry. Angus shops in Montreal have begun production of tanks at a planned rate of 30 a month. British and Canadian orders for them total $63,000,000. Meanwhile thirty-four Canadian shipyards are ahead of the construction schedule in the $60,000,000 navy program.

The Bren gun plant will be doubled. A $400,000 addition will permit the construction of bipods, formerly manufactured in England, for the Bren guns. Meanwhile the Canadian General Electric Co. has started a $1,000,000 addition to its Peterborough plant. The Citadel Merchandising Co., formed six weeks ago, has already bought over $15,000,000 of machine tools. Factories under construction are valued at $120,000,000 at present. This is scheduled to add $500,000,000 yearly to Canada's productive effort.

MONTREAL—At least 1,500 planes are to be built in Canada this year. Next year the schedule calls for 2,400. In a short time Canadian production should provide airplanes at the rate of 200 a month.

The increased produce of fighting planes has been helped by the step-up in the Canadian production of elementary training aircraft which are being used as a part of the Empire pilot training scheme in Canada. Although original contracts called for deliveries up to the end of next year, the accelerated building program calls for deliveries to be completed by the end of 1940. To date more than 20 percent of the original 808 training planes ordered have been delivered.

Although the manufacture of Bristol bombers and Hurricanes has also been increased, future production will emphasize output of American type planes. Arrangements have already been made for the importation of engines and parts from the United States, and plans for future production are of design, material and equipment available on this continent. This will enable manufacturers to fill specifications which are in no way dependent on Britain. Canadian Associated Aircraft will begin mass production at once.

About 12,000 men are now employed in aircraft production in Canada and many more are to be added soon. This month five additional flying schools were started which puts the present air training program about three months or a year ahead of the original schedule.

Tanks to Use Radial Diesels Manufactured by Buda Company

WASHINGTON—Guiberson radial (air-cooled) diesel engines, of which the Army has just ordered 500 at a cost of $2,915,255, will be used to power tanks. Army tanks for some years have used radial engines exclusively, but this order brings the diesel engine for tanks out of the experimental stage for the first time. It also sets up the potentiality of a policy conflict, since other quarters in the administration are dead set against any military reliance on diesels—pointing to less adequate distribution of diesel fuel and comparative scarcity of good diesel mechanics.

The Guibersons will be built under license by the Buda Co., which is expanding its Harvey, Ill., plant to attain a production of eight to ten engines a day.

DEFENSE CONTRACTS SOAR

WASHINGTON—Both the War and Navy Departments hit the ceiling this week when the defense commission released a long list of contracts totaling $1,650,000,000, reported as having "cleared." The inference is that the defense program is going ahead great guns. However, some contracts may not be signed until plants are amortized.

Auto Plants Cannot be Converted Quickly to Armament Manufacture

DETROIT—"A popular American belief has it that automotive industries in the U.S. can easily be converted overnight to aircraft and armament production. But this is not true!"

So exploded A. G. Wickman, president of A. G. Wickman, Ltd., leading British machinery concern, and also president of the British Hard Metal Association.

According to Mr. Wickman, much of Great Britain's industrial equipment for the production of automobiles, etc., cannot be used for the manufacture of shells, aircraft, or aircraft engines. In the U.S. Mr. Wickman believes that automobile manufacturing equipment in war time can be used only for the production of ambulances, trucks, and vehicles of a similar nature.

"The rapid pick-up in British armament production is due," Mr. Wickman feels, "to the increased availability of carbide cutting tools." As both German and English machine tool manufacturers use carbide 100 percent, Wickman is surprised that the U.S. does not use carbide tools more extensively. The modernization of many smaller industries in the U.S. lags far behind that of Great Britain and Wickman thinks that particular attention should be paid to the production of accurate shell forgings.

In this connection a 1940 Inventory made by AMERICAN MACHINIST revealed that not more than 30 to 40 percent of Britain's industrial machinery is over ten years old. This is to be compared with an estimated 70 percent or more ih the U.S.

Another factor is "chip control". For example, Wickman indicates that if older types of shell turning lathes in the U.S. were operated at the speeds used in Britain, the machine and operator would be buried under chips in short order. He concludes with the observation that production is a chain of events and that it is useless to coordinate the most modern turning methods with other antiquated links in the production chain, as those will only pull down the efficiency of the whole production line.

INSIDE DETROIT

Interior decoration of 1941 cars will depend more upon an expanded use of thermoplastics. Industry is interested in molding equipment; sees several changes in production practice

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Richer interior decoration of 1941 cars will depend in a large degree upon expanded use of thermoplastics. As compared with current models, Ford, Chrysler, Hudson and Packard are expected to raise consumption of these materials by as much as 30 percent. The additional weight per car is not great, being only a pound or so. Plastic goes a long way, as evidenced by the fact that an instrument panel insert 28½ in. long weighs approximately 10 oz.

Consumption of thermosetting plastics is expected to be approximately the same in weight as for 1940 models. Phenolic compounds are used mainly for non-decorative purposes, such as for electrical parts and others hidden from view. On the other hand, thermoplastics, usually cellulose derivatives, lend themselves to colorful applications. Brighter colors and better color harmony of car interiors are watchwords in design of 1941 models, hence more lavish use of plastics upon the instrument board, window valances, garnish-molding inserts, and hardware.

Considerable interest in molding equipment was displayed earlier in the year. It seemed for a time that more automobile manufacturers would set up their own molding facilities because consumption on some models runs into several hundred thousands of pounds of plastic materials per year. But interest faded, either because of national defense plans, or because jobbing shops can supply molded parts at lower cost. Yet Chrysler has added to its molding equipment, and Ford has made arrangements to increase daily output by 50 per cent.

Ford's plastic molding division has been moved from the glass plant to the tire plant, where it occupies a space measuring 90x250 ft. at one end of the building. Four production lines are laid out along the 250-ft. dimension. Line No. 1 is devoted to machining and finishing parts molded from thermo-setting soy-bean materials. Line No. 2 consists of sixteen injection molding machines for thermoplastics. Line No. 3 is utilized for machining and assembling thermoplastics and Line No. 4 includes platen-type molding machines for thermosetting plastics. Approximately 450 men are employed during the height of the season.

Molding equipment has not been increased, but new methods will permit manufacture of 250,000 pieces per day for 1941 models, as compared with 165,000 pieces during the season now ended. New parts will also be handled—25 additional items in thermoplastic and 6 in soy-bean plastic, making a total of 97 thermoplastic and 30 soy-bean plastic items. The step-up in production is to be brought about by the following changes in practice.

Production Methods Change

1. Molding of inserts will be avoided so far as possible. Instead, inserts will be bench assembled. Output of the injection molding machines will be doubled or tripled because open mold time will be sharply reduced.

2. Simplification of items. One knob, for example, will be used in several additional ways, by application of suitable pressed-in connections. One mold will make five knobs at once or 20,000 per day. Or other parts can be made with a low-production knob.

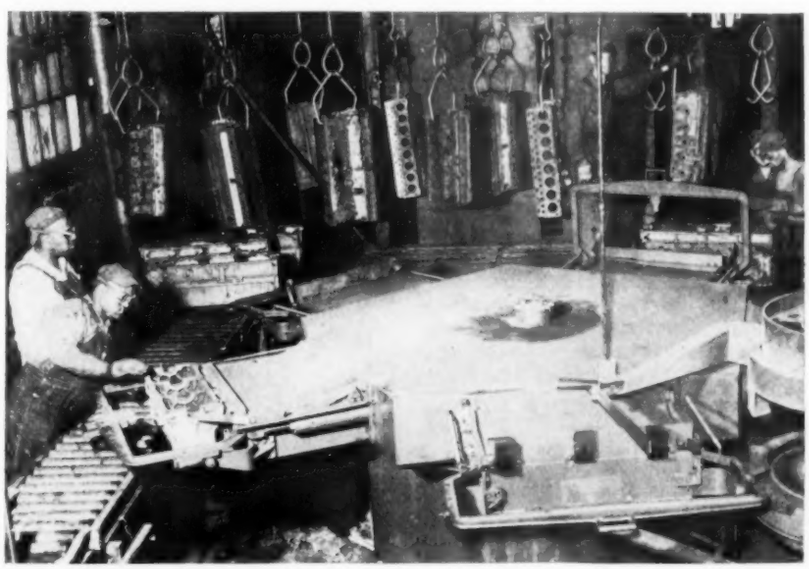
3. Cam molds are being eliminated wherever possible. In some cases, cores are being operated by hydraulic cylinders. In others, the parts has been redesigned. For example, a knob with a collar is now to be made in two pieces. There will be no mold parting line to finish. Placing a touch of cement on the collar and pressing it onto a shoulder on the knob simplifies and speeds up production.

4. Lettering is not being molded into the part. Instead, part numbers and other information are being applied by decalcomania transfers. Or, a light switch will be made of clear plastic and covered with a metal cap with the letter L perforated therein. Illumination through the cap will add a new decorative touch, permit finding the knob more easily.

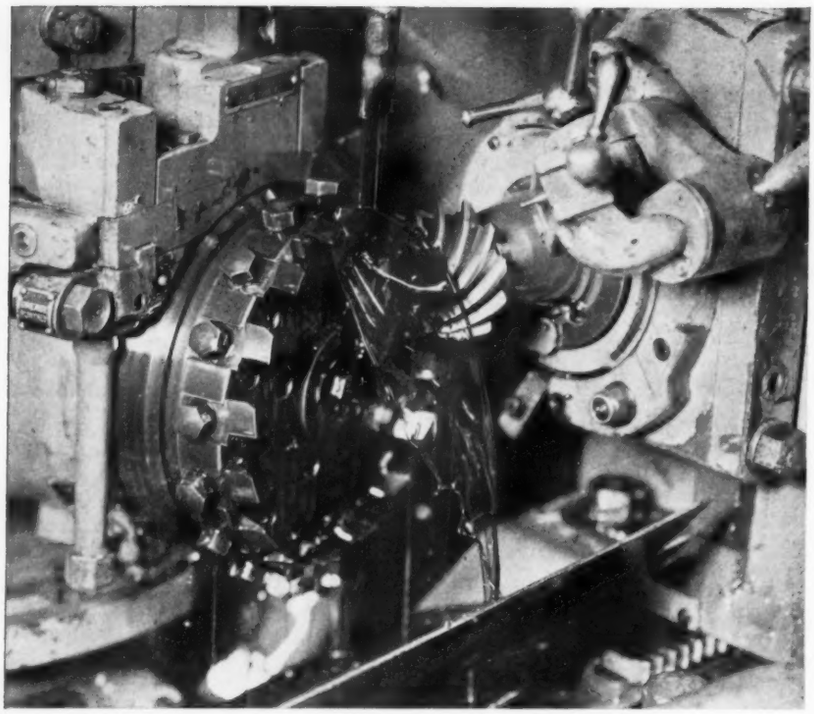
Since inserts will be avoided in the molding process, other means must be utilized for fastening metallic parts firmly to plastic pieces. Pressing is the logical method. Technique has been worked out so that a pull of several hundred pounds, or more than will be encountered in service, must be exerted to separate the assembled components.

FISHER MAY BUILD AIRCRAFT

DETROIT—Fred J. Fisher, a founder of Fisher body, is reported to have made an agreement with William B. Stout, whereby ample production facilities will be provided for building the latter's stainless-steel, training type airplane. Eventually mass production methods are expected to reduce the cost of each ship to $1,000. To complete and license the model may take six months, after which a new plant will be built.



Automatic Snagging—*Part of Pontiac's $1,000,000 renovation program for 1941 consists of this automatic top-and-bottom grinder for cylinder blocks. Machine saves on wheel cost and labor compared with hand swingframe grinding; removes fins only*



High Speed Photo—*In 30,000th of one second the action of a gear cutter generating a bevel-drive pinion gear was "caught" on a photographic plate. The oil, which to the naked eye covers the entire gear and grinding teeth, appears as a solid, frozen sheet to the camera lens*

Because of the small size of thermoplastic parts it is desirable to perform all machining and assembly operations upon benches. For this reason, the plastic molding division asked the Ford tool design department to design presses and drills of Lilliputian size, approximately 2 ft. high. These units are faithful replicas of high-class full-size machines, occupy little space on the bench and afford maximum handling ease and utility. Fixtures are readily changed and every safety precaution is incorporated.

Assembly benches are connected to the injection molding machines by chutes. The machine operator tosses inspected pieces into the chute leading to the assembly bench, throws scrap and sprues down another chute leading into an inclosed belt conveyor running to the compound regrinding department. One bench operator may easily keep pace, in some cases, with the output of two injection molding machines.

Symphonic Styling

Hudson's bid for sales in 1941 is centered about pleasing women buyers through an advanced development in color harmony. "Symphonic Styling", as it is called, offers at no extra cost a selection of interior color combinations that harmonize with exterior body color. Up to now one upholstery color has usually done duty with every body color.

Symphonic Styling offers three interior combinations—grey, green and tan—the one selected being determined by the exterior color. For example, if tan is the basic color harmony selected, the exterior body color, and the unholstery, headlining, trim, carpets, floor mats and instrument panel, will be in harmonizing shades of tan. Hudson is able to take this forward step in color harmony because factory operations have always been kept flexible, to build cars to customer's option, not for dealer stocks.

Hudson's three new lines on 116, 121 and 128 in. wheelbases offer engines from 92-128 hp. New "torpedo type" styling has increased the body length 5½ in., lowered the body height by 2 in., and increased luggage space 25 per cent. Wheelbases are longer. New models were seen at a private showing on July 19. It is likely that Hudson will again beat the field for new-model announcement, but others are close behind this year.

1940 PRODUCTION ENDS

DETROIT—With Chevrolet production decreased during the week of July 22, and Ford planning to drop current models this week, assembly of 1940 cars is at an end. Most other manufacturers discontinued current models at the end of June or during the first or second weeks of July. By mid-month Hudson was shipping 1941 lines to dealers, and Packard last week was in operation again. First press preview will be held by Buick on August 13, when reporters will be given a chance to drive cars with new performance characteristics in view of higher octane fuels available this fall.

Warner Aircraft

An order for 250 engines and spare parts for training ships has been placed with the Warner Aircraft Corp., Detroit, by the British Purchasing Commission, acting for the Australian government. These are current-model engines and production is being fitted into the larger production bank for domestic purposes. Delivery will be completed by early spring.

No expansion of the plant will be required because of the British order, and none is foreseeable on account of expanded purchases from government sources. The government is not expected to go hog-wild on procurement of training ships, and it is likely that Warner and its competitors can handle the engine business with present facilities. Warner stands a good chance of getting procurement orders because it builds engines from 125–165 hp. The Civil Aeronautics Authority is reported favorably inclined toward the 125 hp. model, while the Army and Navy are considering the use of smaller engines in training ships, thereby permitting purchase of the 165 hp. model.

Equipment vendors have been busy quoting prices to as many as ten sources for equipment to make 50 caliber and aircraft machine guns. Evidently the government wants bids from a number of sources, in order to balance all the factors involved before letting contracts.

Associated Machine Tool Dealers In Convention at Dayton, Ohio

The Associated Machine Tool Dealers of America will hold their annual convention Oct. 21, and 22 at Dayton, Ohio.

Among the members of the program committee are the following: George E. Young and C. H. Gosiger of C. H. Gosiger Machinery Co.; J. W. Barbour, E. A. Kinsey Co., Inc.; and E. J. Seifreat, Seifreat-Elstead Machinery Co. All are from Dayton, Ohio.

W. J. Radcliffe and E. B. Andrews of E. A. Kinsey Co., Inc.; E. C. Elstad, Seifreat-Elstad Machinery Co.; and E. A. Shiver, Motch & Merryweather Machinery Co. All are from Cincinnati, Ohio.

WATCHING WASHINGTON

Tentative priorities division set up in the Army and Navy Munitions Board. Training program to increase production level of present skilled labor; defense legislation continues

By ROBERT COLBORN

WASHINGTON—Dress rehearsal for priorities has started. A priorities division has been set up in the Army and Navy Munitions Board, headed by Lieut. Col. A. B. Johnson, which will set up a more or less informal mechanism easily convertible into a definite priority system. Plans made by the division clear through Donald Nelson, defense commission coordinator of procurement. When actual priorities are brought in, Nelson, a former Sears-Roebuck purchasing executive, will be in charge. Press reports that Leon Henderson will have the job are incorrect.

Primary job of the priorities division is to establish the relative urgency of various Army and Navy orders, to keep manufacturing geared to the orderly expansion of the armed forces. It will decide that this order for tank armor comes ahead of that order, with a ship's armor order in between.

Priority of military over commercial orders is intended to be attained simply through the delivery date on the contract. When the supplier takes the contract he obligates himself so to reshuffle his existing orders that he can meet the delivery date. Whether suppliers themselves will demand formal priorities to protect themselves against resentment of commercial customers remains to be seen. In any case little trouble is expected except perhaps in a few items such as armor plate, optical glass, certain aluminum products, rifle boring machinery, and heavy forgings.

Where this system might break down is in the case of sub-contractors and material suppliers. If difficulty develops, the defense commission will be called in. Although admitting that priorities will come sooner or later, the commission wants to stave them off as long as possible. Probable first step will be informal industry-wide agreements such as the one already worked out by machine tool manufacturers.

Groundwork for a similar arrangement in the forging field was apparently laid late last month when representatives of fifteen manufacturers of heavy forgings were called to Washington to meet with Army, Navy, Maritime Commission, and defense commission officials. They were informed that the three agencies will need over the next three years about 360,000 tons of heavy forgings—guns up to 16 in., ship shafting, rudder posts, turbine rotors, etc. No formal action was taken at the meeting beyond this announcement, and no date was set for a later meeting. It is presumed, however, that the manufacturers will discuss the assignment and determine what expansion is feasible and whether allocations of deliveries will have to be made.

Legal basis for priority of military over civil orders, whenever the President desires, was established in recent legislation. It is thought likely however that further legislation will be sought soon permitting priorities as between different commercial orders.

Defense Training Speeded

Meanwhile the defense training program is beginning to get away from its first chaotic visions of millions of high school boys learning to be machinists. In an effort to coordinate the half dozen agencies attacking the training program, Sidney Hillman, defense commission labor man, late last month called in a committee of six industrialists (airplanes, steel, ships, electrical goods) and six labor leaders to set up some kind of over-all policy. They agreed that the route to quick results is to step up the level of present skilled labor rather than try to start from scratch—i.e. turn a machinist into a tool and die maker and a machinist's helper into a machinist. The two big reservoirs are the unemployed skilled men and the men now employed at lower-grade skilled jobs. The first group, where the main problem is refurbishing dusty skills, is to be handled through the WPA-Office of Education program, which already has 40,000 men under training and is working towards 150,000. The second group will be a job for industry itself to handle through various forms of in-service training.

Meanwhile, the Labor Department announced that the defense program had resulted in a contra-seasonal increase (235,000) in June industrial employment. It estimated that, as of June, more than 300,000 men were employed in defense industries: Shipbuilding, 88,600; aircraft, 70,300; machine tools, 64,800; engines, 50,600; aluminum, 27,000; explosives, 7,500. Percentage increases in these industries over 1937 were 26, 46, 18, 18, 3, and 2 respectively.

Defense Head—*Harold Vance, chairman of Studebaker, has charge of machine tools for the National Defense Advisory Commission under William S. Knudsen*

Legislation Continues

With Congress likely to stay in session till after election, the mill of defense legislation grinds along. The two-ocean navy bill authorizing a 70 percent expansion of the permitted size of the fleet has been signed and is now law. Lots of people still do not understand that there is no money in this bill. It merely authorizes the Navy to go ahead when Congress provides the $4,000,000,000 needed. Only a few hundred million for the necessary shipyards and armor plants will be provided this year. Congress has passed a measure appropriating $25,000,000 to start a $65,000,000 defense power project in the Tennessee Valley. Major items still pending are as follows:

The $5,000,000,000 appropriation to provide equipment for a 2,000,000-man army and 19,000 more planes. This bill will pass soon substantially unchanged. The rider which raises airplane profits is academic, since the tax bill will substitute a different system.

This bill limits armament profits, establishes amortization procedure for defense plants, and repeals special limits on profits.

Wright Aeronautical Locates $92,000,000 Plant at Cincinnati

WASHINGTON—Decision of Wright Aeronautical to locate its $92,000,000 engine plant at Cincinnati not only doubles Wright's production of military-type radial engines, adding 12,000 a year of capacity, but also marks the first big break in industry's resistance to the administration's desire for decentralization of defense plant.

By the same token it substantially reduces the likelihood of government construction of plant facilities paralleling private industry. Government plants definitely scheduled (the $25,000,000 powder plant near Louisville, Ky., a shell-loading plant soon to be announced, etc.) are for products with no commercial equivalent. Possibility of other types arose through desire to control locations—admittedly not possible as regards private expansions—or through too slow private plant construction. Fruition of the long pending Wright negotiations was a major cause of the War Department's announcement that it contemplated no immediate construction of federal aircraft plants.

The Wright plant is being financed through an RFC defense loan and is the first big one apart from the $165,000,000 loaned to the RFC-created metals and rubber corporations for purchase of strategic materials. Nine smaller loans aggregating $16,000,000 have been made, but RFC has made no statement as to the recipients.

Disinterested Executives Seen Responsible for "Learner" Failures

SILVER BAY, N. Y.—Lack of attention by top executives is largely responsible for failure of "learner" training programs wherever they have proved unsuccessful, stated Warner Seely, secretary Warner & Swasey Co., in a talk July 25 at the annual Silver Bay Industrial Conference. Once launched, these programs sometimes have been allowed to drift along without proper study, supervision and direction.

Mr. Seely pointed out that the most important factors in operating a learner program are a careful selection of trainees, getting foremen training-conscious, and making a frequent and accurate check-up of individual learner's progress. The learner courses are generally considered the most effective single method of attacking the emergency training problem. Classroom work consists of blueprint reading, shop mathematics, use of measuring instruments, elementary applied mechanics, and machine shop practices. It is followed by training in the plant.

U. S. Government Contracts Awarded to Metal-Working Firms

(Other Metal-Working Contracts on Page 590d)

Contractor	Gov't Agency	Commodity	Amount
Babcock Printing Press Corp., New London, Conn.	War	Machined shell	$183,131
American Forge Div., American Brake Shoe & Foundry Co., Chicago, Ill.	War	Shell forgings	70,235
Lundquist Tool & Mfg. Co., Worcester, Mass.	War	Telescope mounts	144,950
Fort Pitt Bedding Co., Pittsburgh, Pa.	War	Metallic belt links	419,200
Guide Lamp Div., General Motors Corp., Detroit, Mich.	War	Cartridge cases	149,362
Caterpillar Tractor Co., Peoria, Ill.	Navy	Tractors	62,640
International Harvester Co., Chicago, Ill.	War, procurement	Tractors	88,116
General Motors Corp., (Chevrolet Div.), Detroit, Mich.	Agriculture	Trucks	117,416
Fairchild Aircraft Div., Fairchild Engine & Airplane Corp., Hagerstown, Md.	CAA	Airplanes	50,050
Thomas B. Martindale, Inc., Philadelphia, Pa.	Navy	Station wagons	34,790
Yellow Truck & Coach Mfg. Co., (General Motors Truck & Coach Div.) Pontiac, Mich.	War	Trucks	68,380
United Aircraft Corp., East Hartford, Conn.	Navy	Aircraft magnetos	24,725
Weatherhead Co., Cleveland, Ohio	Philadelphia	Couplings and fittings	42,697
Gruman Aircraft Engineering Corp., Bethpage, N. Y.	Navy	Parts for airplanes	32,895
Marmon-Herrington Co., Indianapolis, Ind.	War	Trucks	99,778
Pullman-Standard Car Mfg. Co., Pittsburgh, Pa.	War	Shells	253,987
Lake Washington Shipyards, Houghton, Wash.	Navy	Tank baulks	394,250
Doehler Die Casting Co., Pottstown, Pa.	War	Die castings	50,087
Struthers Wells-Titusville Corp., Titusville, Pa.	War	Breech rings	23,156
Edwards Mfg. Co., Cincinnati, Ohio	Navy	Practice bombs	53,100
Merit Supply Co., New York, N. Y.	Air Corps	Chock assemblies	31,248
General Bronze Corp., Long Island City, N. Y.	Air Corps	Cradle assemblies	29,044
Farrel-Birmingham Co., Ansonia, Conn.	United States	Rolling mill unit	23,396
Kay Products Co., Detroit, Mich.	War	Engine hoists	31,800
Yale & Towne Mfg. Co., Stamford, Conn.	War	Fuel servicing pumps	122,629
Corbitt Co., Henderson, N. C.	War	Trailers	30,455
Fargo Motor Corp., Detroit, Mich.	War	Trucks	929,265
Pump Engineering Service Corp., Cleveland, Ohio	War	Pump assemblies	36,066
Meili-Blumberg Corp., New Holstein, Wis.	Navy	Trailers	25,264
Steuart Motor Co., Washington, D. C.	Procurement	Automobiles	26,204
Link Aviation Devices, Inc., Binghamton, N. Y.	War	Trainer assemblies	509,182
Mack International Motor Truck Corp., Washington, D. C.	War	Transportation auxiliaries	82,860
Hart Mfg. Co., Louisville, Ky.	War	Army ranges	59,578
Wm. R. Bootz, Evansville, Ind.	War	Fire units for field range	50,724
Remington Rand, Inc., Buffalo, N. Y.	War	Cabinets for field range	98,839
American Safety Razor Corp., Brooklyn, N. Y.	War	Safety razors	29,064
Eclipse Aviation Div., Bendix Aviation Corp., Bendix, N. J.	War	On-carriage parts	267,491
Peco Mfg. Corp., Philadelphia, Pa.	War	Eyebolt lifting plugs	106,917
North & Judd Mfg. Co., New Britain, Conn.	War	Tips, cla ps and slides	35,431
Hunter Steel Co., Pittsburgh, Pa.	TVA	Radial gates	202,000
Marshall Stove Co., Lewisburg, Tenn.	War	Stoves	25,002
St. Louis Furnace Mfg. Co., St. Louis, Mo.	War	Room heaters	27,982
Phillips & Buttorff Mfg. Co., Nashville, Tenn.	War	Heating stoves	22,210
Aluminum Cooking Utensil Co., New Kensington, Pa.	War	Range equipment	67,719
General Fireproofing Co., Washington, D. C.	Navy	Aluminum chairs	83,093
General Bronze Corp., Long Island City, N. Y.	War	Dolly assemblies	54,652
Scovill Mfg. Co., Waterbury, Conn.	War	Primer bodies	276,000
Electric Boat Co., Groton, Conn., Maxim Silencer Co., Hartford, Conn.	Navy	Mufflers, evaporators, distillers	64,260
York Ice Machinery Corp., Philadelphia, Pa.	Navy	Refrigerating equipment	126,641
General Electric Co., Schenectady, N. Y.	Aeronautics, War	Electrical equipment Propeller-drive unit	75,622
Stinson Aircraft Div., Aviation Mfg. Corp., Nashville, Tenn.	CAA	Airplane	24,070
Engineering & Research Corp., Riverdale, Md.	Navy	Blades	81,100
American Car & Foundry Co., New York, N. Y.	War	Tank cars	216,054
Fate-Root-Heath Co., Plymouth, Ohio	War	Locomotives	33,912
Stearman Aircraft Div., Boeing Airplane Co., Wichita, Kansas	Navy	Airplanes	3,779,628
Ranger Aircraft Engines Div., Fairchild Eng. & Airplane Corp., Farmingdale, N. Y.	Navy	Airplanes engines	5,489,308
Bath Iron Works Corp., Bath, Maine	Navy	Destroyers	9,796,000
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.	Navy	Destroyers	10,554,000
Bendix Aviation Corp., Marine Div., Brooklyn, N. Y.	War	Range correction boards	76,573
Eastman Kodak Co., Rochester, N. Y.	War	Telescopes	39,922
Bausch & Lomb Optical Co., Rochester, N. Y.	War, Navy	Telescopes, trainers	281,218
Sperry Gyroscope Co., Brooklyn, N. Y.	War	Searchlights	803,400
Bendix Aviation Corp., Pioneer Instrument Div., Bendix, N. J.	War	Indicators and transmitters	31 920

NAMES in the NEWS

Frank H. Gordon, vice-president in charge of sales at Lukens Steel Co., Coatesville, Pa., recently celebrated his 45th anniversary as an associate of the company. After having held various clerical positions in the organization, Mr. Gordon was named assistant general sales agent in 1903. He has been vice-president since 1928.

R. A. Hill, formerly mid-continent manager for the Regan Forge & Engineering Co., has been appointed manager of a new branch office and warehouse in Houston, Texas., to be opened by John A. Roebling's Sons Co., Trenton, N. J. Mr. Hill will have charge of sales and the local stock of Roebling's complete line.

Howard R. Salisbury has been appointed manager of the Air Reduction Sales Co. at Philadelphia, Pa. He has been connected with Airco for fifteen years.

J. Eugene Jackson has been appointed metallurgical engineer of the Copper Iron & Steel Development Association, Cleveland, Ohio. He will act as technical service representative of the association of copper producers.

Clinton E. Stryker has been appointed vice-president and assistant to the president of the Nordberg Mfg. Co., Milwaukee, Wis.

C. O. Bartlett has been appointed district manager in the Detroit territory for the C. O. Bartlett & Snow Co., Cleveland, Ohio. Mr. Bartlett is the son of the founder and organizer of the company.

James H. Jewell has been named manager of agency sales by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

John A. Brown has retired from Heppenstall Co., Pittsburgh, Pa., after having served for 40 years. Harry E. Reith, formerly with Brooks Oil Co., has been appointed special service representative, the position formerly held by Mr. Brown.

George I. Allen, office manager of Heppenstall Co., Cleveland, Ohio, has also retired. He is being succeeded by his son, Jack R. Allen.

G. V. Patrick has been appointed director of sales for the Cleveland Automatic Machine Co., Cleveland, Ohio. H. A. Gray, formerly connected with the U. S. Army Ordnance Department, succeeds Mr. Patrick, as eastern sales manager. F. C. Reese, formerly sales engineer with the Cincinnati Milling Machine Co., has been appointed district sales manager with offices at 314 American Building, Cincinnati, Ohio.

Celebrates Anniversary

FRANK H. GORDON

District Manager

C. O. BARTLETT

New Appointee

J. EUGENE JACKSON

Charles F. Woodward was named manager of Western Steel Products Corp., Ltd., company's office and factory at Calgary, Alberta, Canada.

Lawrence Rigdon, Carl Coler and William O'Connell have been appointed to the posts of manager of manufacturing, manager of industrial relations, and auditor respectively, of the Emergency Products Div., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This division, which has been organized just recently, will produce defense equipment under the government's preparedness program.

J. Russell Penman has been appointed production manager in Copperweld Steel Company's new alloy steel plant in Warren, Ohio. Mr. Penman was previously connected with Central Steel Co., Republic Steel Corp., and United States Steel Corp.

Claire C. Balke has rejoined the Research Staff of Fansteel Metallurgical Corp., North Chicago, Ill.

Frank W. Ladky, Wisconsin representative for the Corey Steel Co., Cicero, Ill., for the past twenty years, has been elected a director of the company.

John P. Moran, vice-president in charge of production of the Gemmer Mfg. Co., Detroit, Mich., has been elected president to succeed the late Edward P. Hammond. Mr. Moran has been a member of the company since 1910.

Aircraft engineer, Carleton E. Stryker, has been added to the headquarters staff of the Society of Automotive Engineers to take charge of the society's national defense responsibilities pertaining to aircraft and aircraft-engine parts and materials.

Alexander Sellers, president of William Sellers & Co., Philadelphia, Pa., has been elected chairman of the board. He is succeeded as president by George H. Benzon, Jr., who has held the post of vice-president.

PLANT EXPANSION

Cowles Detergent Co., Cleveland, Ohio, has moved to larger offices at 7016 Euclid Ave.

Falk Corp., Milwaukee, Wis., is scheduled to erect a $50,000 addition to its existing plant.

Union Carbide & Carbon Corp., New York, N. Y., is expanding its plant in Kokomo, Ind., by the addition of a new one-story factory building. The new structure will house machinery to be used in the manufacture of Haynes Stellite alloy products.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., will construct a new $560,000 warehouse which will provide an additional 126,000 sq.ft. of space. A new metal stamping building which will cost approximately $500,000, and an additional construction of two stories on one of the main buildings of the plant are added features of the organization's expansion program.

Marmon-Herrington Co., Indianapolis, Ind., is scheduled to double the size of its factory in conjunction with its active participation in the new national defense program.

Worthington Pump & Machinery Corp. will construct a new $75,000 addition to its Buffalo plant. The new unit, 145x114 ft., will be used to expand the assembly and testing de-

partment of the larger gas and diesel engines.

Curtiss-Wright Corp. has filed a petition with the Tonawanda Town Board to erect a new $100,000 office building at Tonawanda, N. Y.

An addition to the aircraft factory building of North American Aviation, Inc., is being erected at 5701 Imperial Highway, Los Angeles, Calif. The expansion will cover an area of 25 x 420 ft. at a cost of $24,000.

Menasco Mfg. Co., Los Angeles, Calif., will erect a new aircraft engine factory at Burbank, Calif. The new building will have an area of 50,000 sq. ft. of floor space and is scheduled to be completed in 90 days.

Curtis Lighting, Inc., manufacturers of lighting equipment, is expected to erect a $175,000 general office and factory building at Paducah, Ky. The company, now located at 1123 W. Jackson Blvd., Chicago, will be moved as soon as it secures a title for a plant site and $35,000 to be raised by public subscription.

Work has begun on a new $2,000,000 headquarters for the General Electric Co., at 840 So. Canal St., Chicago, Ill. The building, which is scheduled to be completed in September will occupy one square block, have seven stories, and house nine General Electric divisions.

Ericcson Screw & Machine Co., Brooklyn, N. Y., will construct a $75,000 factory unit on the Boston Post Road at Norwalk, Conn.

United Aircraft Corp., East Hartford, Conn., has leased the entire first floor of the three-story plant of Cheney Bros. at Manchester, Conn. The Aircraft Co. now has 19,000 sq. ft. of floor space which will be used for storage purposes.

OBITUARIES

Paul S. Moyer, chairman of the board, Aridor Co., Chicago, Ill., died recently, at the age of 49.

Fred Beswick, 45, former superintendent of the foundry at Caledonia Bean Harvester Co., died at his home in LeRoy, N. Y., following an illness of several months. Ill health had caused Mr. Beswick's retirement.

William Henry Harrington, 48, Eastern sales manager of New Departure Div. of General Motors Corp. at Bristol, Conn., died recently following an operation. Mr. Harrington had been associated with New Departure since 1917.

Dies

CHARLES H. HELLER

Charles H. Heller, chairman of the board, Bower Roller Bearing Co., died suddenly July 26. With R. F. Bower and others, Mr. Heller organized the Bower Co. at Dayton, Ohio, in 1907.

Charles A. Goodspeed, who was connected with Henry Prentiss & Co. for 40 years previous to his retirement in 1928, died recently.

Fred C. Reis, secretary for many years of the Boye & Emmes Machine Tool Co., Cincinnati, Ohio, died July 23.

BUSINESS ITEMS

Sheller Mfg. Corp., Portland, Ind., manufacturers of steering wheels, has purchased the radiator shutter business of Pines Winterfront Co., Chicago, Ill.

Cummins Diesel Sales of British Columbia, Ltd., machinery dealer, has been incorporated with an authorized capitalization of $10,000. The new firm is located at 703 Rogers Bldg., 470 Granville St., Vancouver, B. C.

Reliance Machine & Tool Co., Ltd., has changed the name of the firm to Reliance Aircraft & Tool Co., Ltd., with offices in Belleville, Ontario, Canada.

John W. Dobson has been appointed an Eastern sales representative of the Cowles Detergent Co., Cleveland, Ohio.

Callite Tungsten Corp., Union City, N. J., has taken over Harris Alloys, Inc.

Ransome Concrete Machinery Co., Dunellen, N. J., has appointed the following sales representatives: Wessendorff, Nelms & Co., 320 Franklin Ave., Houston, Texas; Welding Sales & Engineering Co., 1628 W. Fort St., Detroit, Mich.; Jones-Sylar Supply Co., 1800 Central Ave., Chattanooga, Tenn.; Arcway Equipment Co., 3717 Filbert St., Philadelphia, Pa.; and Hobart Welder Sales & Service, 6715 Carnegie Ave., Cleveland, Ohio.

Fuji Trading Co., Osaka, Japan, has been newly incorporated to take over the entire overseas business formerly handled by the export department of Y. Kodama Shoten.

Walter C. Davis will represent American Machine & Metals, Inc., of East Moline, Ill., in Maryland, Virginia and the District of Columbia.

Republic Machinery Corp., Toledo, Ohio, has been formed to take over the Machine Tool Div., of the National Supply Co. H. E. Oatis, who has been branch manager of the Toledo Store of the National Supply Co., will head the new organization as president and treasurer. Offices are at 416 Richardson Bldg.

Huie Simmer Co., 103 Thomas Bldg., Dallas, Texas, has been appointed district sales representative in the state of Oklahoma for the complete line of Trico Fuse Mfg. Co., Milwaukee, Wis.

Medart Co., St. Louis, Mo., has purchased the entire wood pulley stock of the Reeves Pulley Co., Columbus, Ohio, and will continue to serve all of the wood pulley dealers and customers of the latter organization.

A new company, the U. S. Electric Welder Corp., 1224 W. Bancroft St., Toledo, Ohio, has been incorporated by J. L. Fosnight, who will act as president and general manager.

The Stumpfl Co., Emporium, Pa., manufacturer of cutting tools, is being reorganized into a new firm to be known as the Cameron Mfg. Corp.

MEETINGS

Porcelain Enamel Institute. Fifth annual forum, University of Illinois, Urbana, Ill. Oct. 16–18.

Society of Automotive Engineers. National tractor meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 24–25. Annual dinner, Hotel Commodore, New York, N. Y., Oct. 14.

American Institute of Electrical Engineers. Pacific Coast convention, Los Angeles, Calif., Aug. 26–30.

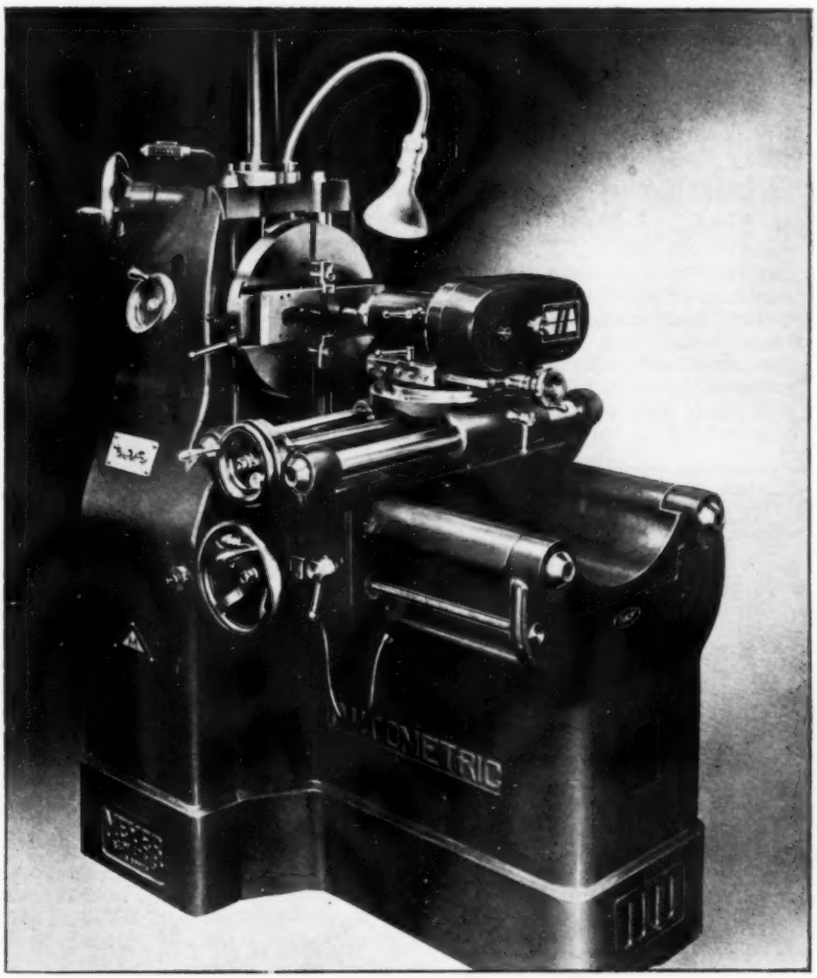
American Society of Mechanical Engineers. Fall meeting, Spokane, Wash., Sept. 3–6.

SHOP EQUIPMENT NEWS

"Autometric" Jig Borer Serves Also As Precision Layout and Inspection Machine

Offered by Meyer Mechanical Laboratory, 1849 Sacramento St., San Francisco, Calif., the "Autometric" jig borer has been designed from the ground up to offer greater accuracy, greater versatility and greater speed of operation in jig boring. In addition to functioning as a jig borer, this unit also serves as a universal layout and inspection machine.

For small-lot production work the versatility and speed of this machine make possible a wide variety of production boring without expensive attachments or accessories. Operations possible on the machine include: locating, boring, inspecting and layout in one set-up; angular boring of holes at any angle; taper boring at any angle; and rapid measuring by built-in mechanical counters. Features include steel ways hardened, ground and lapped, automatically oiled; independent speeds and feeds; infinite number of feeds from zero to 3½ in. per min.; fourteen feeds from 30 to 2,350 r.p.m.; V-belt driven spindle; and super-precision roller bearings in spindle and rotary table.



Grob Metal Bandsaw Built for Toolroom

To fill the increasing demand for an all-round metal bandsaw, Grob Bros., Grafton, Wis., have developed the Model No. NS-18 bandsaw. This machine is built for the toolroom as well as for the general machine shop.

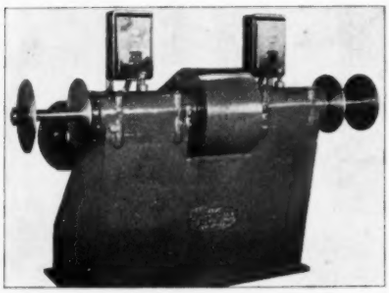
The machine consists of a one-piece welded steel frame, reinforced for rigidity. A cast iron table, 24x24 in., is tiltable four ways. A butt welder with built-in tool grinder is mounted in the frame. Both upper and lower saw guides are adjustable. Lower guide can be brought above the table surface for special jobs.

A 1-hp. motor drives the machine through V-belts. All pulleys are mounted on ball bearings. Speeds range from 50 to over 2,000 ft. per min. Throat is 18 in. deep, and distance from table to upper column is 12 in. Machine will cut extra-heavy jobs with ease, using saw blades up to 1 in. wide. A chart for the proper selection of saw blades is mounted on the machine. Net weight is 1,000 lb.

Rome Polishing Lathe Finishes at Slow Speed

Especially well adapted to the requirements of the slow-speed loose-abrasive method of finishing, the Rome Model THMO heavy-duty two-motor double-spindle polishing and buffing lathe can be arranged for heavy-duty automobile bumper rail polishing and buffing, and can also be equipped with long overhanging wheel spindle housings for agricultural implement finishing.

Machine illustrated is equipped with two 10-hp. totally inclosed fan cooled ball bearing motors and pushbutton operated magnetic starting switches. Motors up to 25 hp. can be accommo-



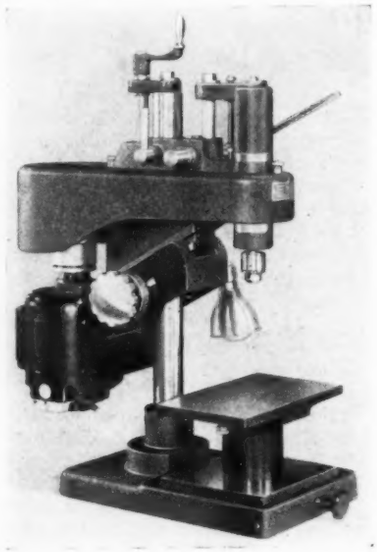
dated in the machine. Spindles will carry 18 to 36 in. diameter, 8-in. face wheels with 2-in. arbor holes. Wheel dust hoods of any design can be furnished to specification, complete with mounting brackets.

Chrome-manganese alloy steel wheel spindles, ground and balanced, are mounted on multi-sealed ball bearings having exceptionally high load capacity. Net weight, complete with two 10-hp. motors, is 3,100 lb.

Super Sensitive Drill Has Wide Speed Range

The "Maxi-Varimatic" super sensitive drilling machine offered by Hamilton Tool Co., Hamilton, Ohio, has been designed to afford greater flexibility of operation and higher performance through the use of an exceptionally wide range of speeds. Complete speed range of the machine is from 840 r.p.m. to 9,300 r.p.m., with a 1,725 r.p.m. motor. Speed adjustment is infinitely variable in two ranges.

This machine is claimed to be built with instrument precision, and to be suitable for use on the finest work in toolrooms, or in instrument, diesel, electrical, aircraft and other precision



manufacturing. Exceptional convenience of operation enhances its usefulness. Drilling unit is self-contained, and swings radially on the column and locks to any position. The 6½-in. vertical adjustment is accomplished by means of an elevating screw.

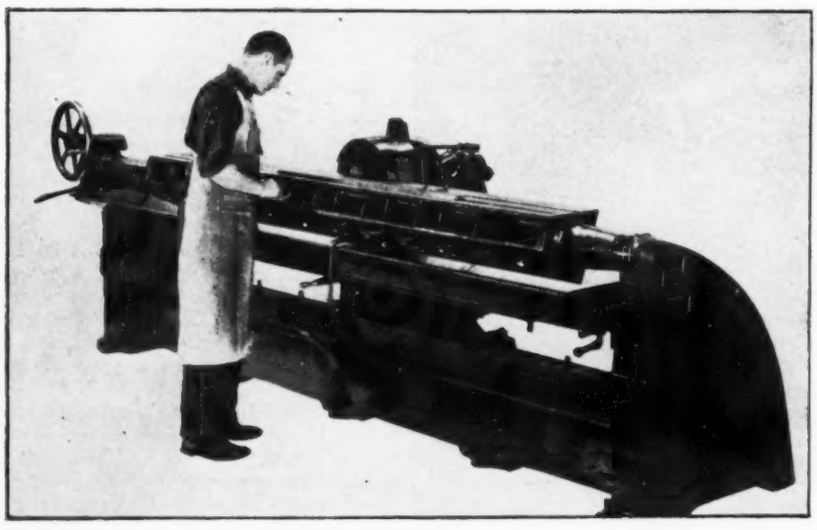
Seybold Precision Shear Knife Grinder Sharpens Most Kinds of Straight Knives

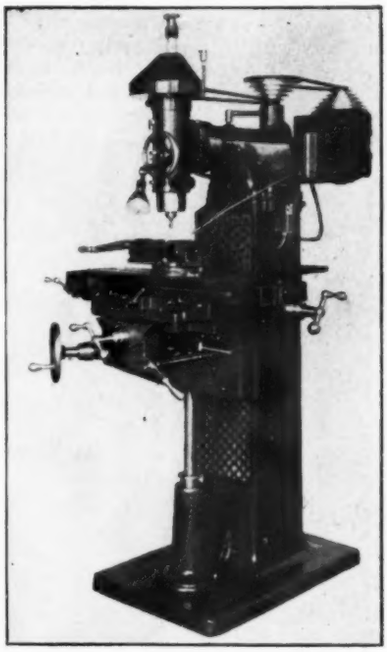
Developed by the Seybold Div. of Harris-Seybold-Potter Co., Dayton, Ohio, a high-speed precision knife grinder is capable of sharpening almost all straight knives in general use. Having an automatic grinding wheel feed and centrifugal pump cooling system, it removes an absolute minimum of metal, quickly producing a keen cutting edge which requires little honing.

Machine does not require an experienced operator, and grinds equally well shear blades or beveled knives such as planer, chipper, hog, barker, veneer, paper, rag, granulating, tobacco, scraper and doctor blades. A unique feature is a hollow three-sided knife bar, each surface of which presents a different series of angles to the action of the traveling grinding wheel. A fourth open side makes it easy to bolt or clamp the various types of blades to the bar.

In designing the machine, special consideration has been given to shear blade grinding. A variety of sizes can be accommodated, and widths up to 6 in. can be ground satisfactorily. Adjacent surfaces of the knife bar are made to accommodate almost all straight edge knives in general use.

Simplicity has been attained without eliminating any of the desirable features of the company's older precision knife grinder, it is claimed. All gears and clutch operate in an oil bath to insure quiet, trouble-free service. Only the floor space occupied by the base is required for operating the grinder. It is made in three sizes, 70-in., 100-in. and 128-in. lengths.





"Millmaster" Vertical Miller Designed for Wide Range

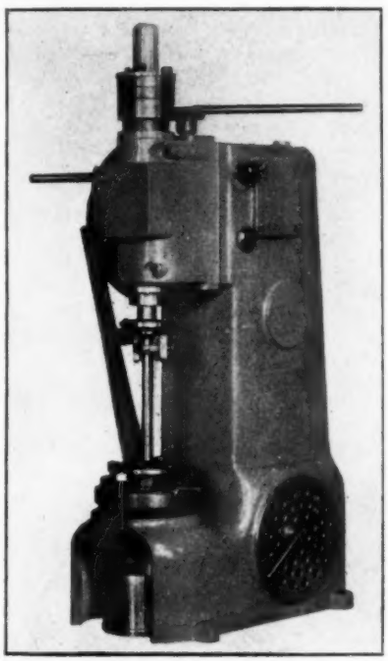
Designed for a wide range of work with high speed and high precision, the No. 2½ "Millmaster" vertical milling machine is offered by Midway Machine Co., 2324 University Ave., St. Paul, Minn. The standard two-pulley model provides spindle speeds of 275 to 4,300 r.p.m., while the three-pulley model has speeds ranging from 70 to 10,000 r.p.m. This wide range of speeds makes the machine extremely versatile, as the same machine may be used for work in metal, wood and plastics without change.

Features include: 1-hp. ball-bearing

motor and reverse controller; preloaded duplex oversize ball bearings on spindle; all flat and V bearing surfaces scraped in against master plate. Over-all height of stationary-quill model is 72 in.; that of movable-quill model is 80 in. Net weight is 1,600 lb.

"Incolap" Gear Finisher Built for Small Gears

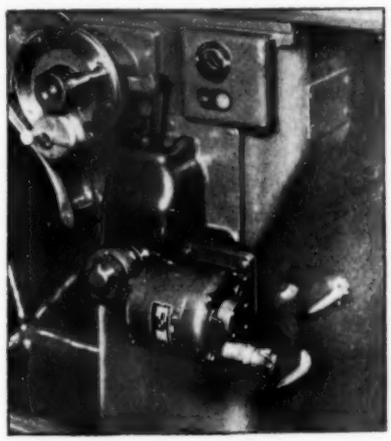
Standing only 32 in. high, the bench model "Incolap" gear finishing and correcting machine is offered by Gear Processing, Inc., 6700 Grant Ave., Cleveland, Ohio. With this unit gears may be rough and finish hobbed,



shaped, or rough cut and shaved. Then after hardening, they go through the laps to remove errors in both cutting and hardening operations. The "Incolap" process is not designed to remove large amounts of stock, but rather to correct gears properly cut with a normal amount of production error.

Primary function of the machine is to reciprocate the gear and surrounding lap in relation to each other. For large production where many gears of the same kind are to be corrected, laps are broached from electric furnace iron and later hardened. For transmission gears, laps are usually from 3/16 in. to 1½ in. thick. For larger gears, and for worms or splines, the laps may be as long as 4 in. By use of thin laps, close clearance gears can be finished, provided there is ⅛ in. between gear being lapped and the adjacent gear or shoulder.

Bench model illustrated will take gears from ¼ to 2 in. in diameter. Weighing less than 200 lb., it has manual control for stopping and starting, for lifting gear for indexing or at the finish of the cycle and for controlling pressure between gear and lap. Provision is made for automatic control of these motions, using a time clock mechanism and actuating air cylinders.



Automatic Cross Feed Available for B&S Grinders

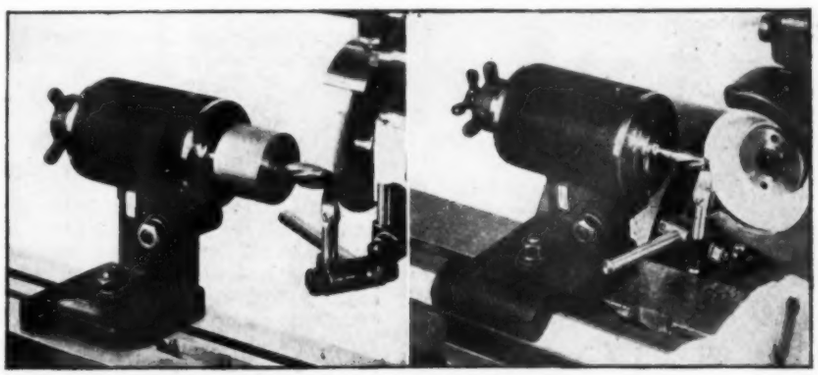
Brown & Sharpe Mfg. Co., Providence, R. I., has developed an independent automatic cross feed arrangement for its No. 5 plain grinding machines. Automatic straight-in-feed grinding, with the machine table stationary, may be performed with this attachment, which gives the machine all the advantages of power plunge-cutting with no change in its regular capacities or operating convenience. The arrangement furnishes 172 plunge-cut feeds or picks per minute, with the amount of feed adjustable by quarter-thousandths from 0.00025 in. to 0.0045 in. per pick. As with the regular cross feed, the stopping point can be set by increments of 0.0001 in.

A separately controlled 1/20-hp. gearhead motor mounted at the right front of the machine drives continuously a variable-radius crank mechanism which is mounted below the similar unit regularly a part of the machine. Arrangement includes a vertical link which transmits motion to the cross-feed pawl from either of two crank mechanisms. Selections of feed for traversing or straight-in-feed grinding is made simply by connecting the link to the proper crank mechanism by a machine screw and hardened bushing fitting either of two holes in the link. Amount of feed per pick is selected simultaneously by a pointer and scale on the rotating members before the screw is tightened. Entire arrangement is simple and compact, and is effectively guarded for safety. It is applied to the machine before shipment from the factory, and increases the weight by approximately 15 lb.

Brown & Sharpe Tool Grinding Attachments Aid in Sharpening Steep Spiral End Mills

Nos. 10 and 13 end mill grinding attachments for B&S No. 10 cutter and tool grinding machine and No. 13 universal end tool grinding machine respectively have been developed by Brown & Sharpe Mfg. Co., Providence, R. I., especially for sharpening the peripheral teeth of steep spiral end mills having straight or taper shanks.

A knob at the rear end of the attachment spindle makes it easy to hold the tooth being ground in contact with the tooth rest, while feeding the cutter across the wheel by a longitudinal table movement. Mounting of the spindle on anti-friction bearings provides a sensitive, free-turning unit, of special advantage when sharpening



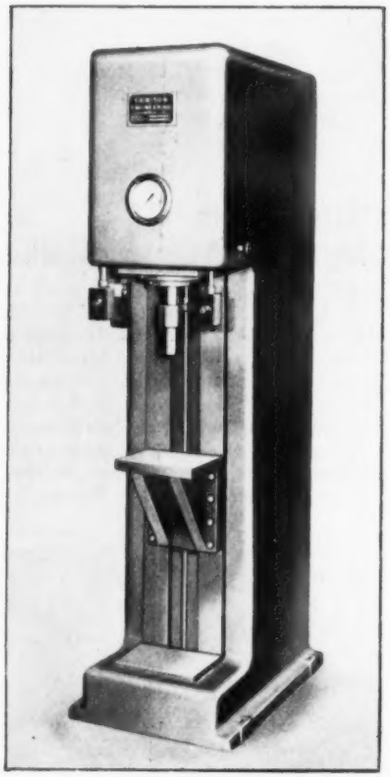
Sharpening the peripheral teeth of steep spiral end mills is made easy with the No. 10 attachment, left, and the No. 13 attachment, right, for the Brown & Sharpe No. 10 cutter and tool grinding machine and the No. 13 universal and tool grinding machine, respectively

very small end mills having a steep spiral.

Attachment spindle is carried in a body supported by and turning horizontally on a base casting. Two zero lines 180 deg. apart assure proper alignment of spindle with machine table when sharpening either right-hand or left-hand cutters. Base is aligned by keys which fit the table T-slot. End mills having a No. 9 B&S taper shank will fit directly into the attachment spindle; while cutters having shanks of other B&S tapers, as well as cutters with milling machine standard taper shanks and straight shanks, are accommodated by stock collets and adapters regularly available. A built-in bolt can be furnished at extra cost for use with spring collets in order to hold straight-shank end mills.

Knee Type Hydraulic Press Permits Rapid Tool Changes

The Type DLKC2 hydraulic press offered by Denison Engineering Co., 236 N. Water Street, Columbus, Ohio, has been arranged especially to facilitate rapid change of tools and fixtures. Suitable for general production press-

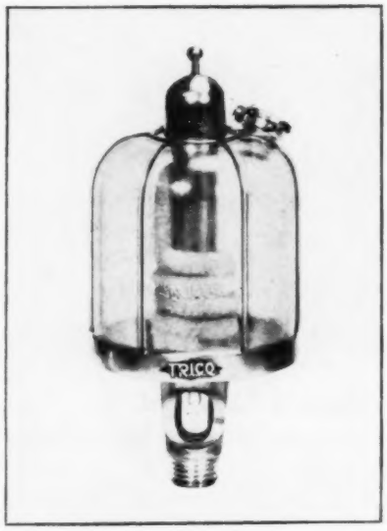


ing operations, it can be quickly retooled with a variety of bolsters, supports or special tools and fixtures. Convenient location of controls, rounded corners and freedom from projections, promote safety and convenience in operation.

Furnished in both 5- and 15-ton capacities, this press is available with either manual or electric control. With electric control, two pushbuttons are arranged so that both must be operated simultaneously. The manually controlled press is furnished with a hand lever or with a foot pedal.

Unbreakable Wick Feed Oiler Aids Intermittent Operation

A visible unbreakable wick-feed oiler offered by Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee, Wis., has been developed especially for use on machinery which operates intermittently.



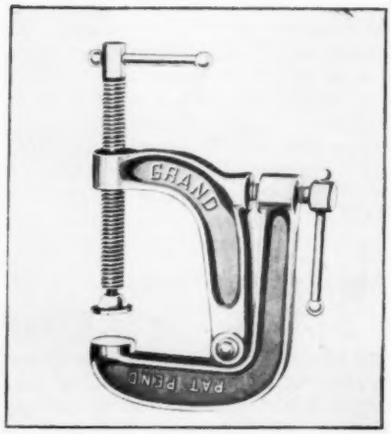
Lever at the top, when in a vertical position, starts the feed, and when flipped to the side, shuts off the feed, preventing flooding and waste of oil when the machine is idle. Oil supply is always visible, and the clear unbreakable reservoir tells at a glance when refilling is necessary.

When oiler is filled above the point where the wick enters the center tube, surplus oil drains into the bearing, thus flushing it thoroughly. When the oil recedes below the opening in the tube, the wick automatically feeds the oil by capillary action. Dirt or sediment cannot enter the bearing. There are no gaskets to leak, as the bottle is cemented and roll-clinched to the heavy brass base. Oilers are available in one, two and four ounce capacities.

Pivoted Clamp Designed To Eliminate Creeping

A clamp offering a solution to the old problem of creeping and shifting of clamps is offered by Grand Specialties Co., 3103 W. Grand Ave., Chicago, Ill. This clamp incorporates the standard clamp principle with an additional vise feature which is said to provide positive grip which eliminates all surface movement of the clamp or material under pressure.

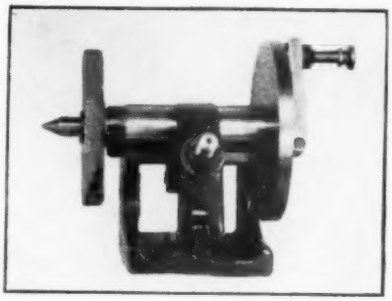
Clamp screw turns in a hinged bracket, the hinge acting as a fulcrum with the base of the clamp



which has a vise screw working against it. It is claimed that this clamp can be used in inconvenient places not accessible to ordinary clamps, and that it develops a holding power that prevents creeping or shifting even on tapered work. It has extra slip-on jaws for clamping pipes, rods and tubing. It is made in two sizes with openings of 3, 4 and 6 in.

Hart Dividing Heads Provide Up To 32 Divisions

Dividing heads of simple construction have been made available by Hart Machine Co., 26 Mather St., Dorchester, Boston, Mass., for a wide variety of work on drill presses, milling machines, shapers and surface grinders. The plain dividing head is mounted on 2½ in. standard milling fixtures



previously described. These heads are available with or without a tailstock assembly. The dividing head can be equipped with a standard driving faceplate as shown, or with a 4 in. Whiton chuck. When arranged with a chuck a hollow spindle which will take up to 9/16 in. round stock is furnished. The index plate is drilled on one side with 18, 20, 22 and 24 holes, and on the other side with 26, 28, 30 and 32 holes. All numbers up to 16 and even numbers up to 32 can be divided.

Heavy Duty Tool Set Built for Maintenance

A complete set of pulling tools designed and built especially for industrial maintenance work is offered by

FULL TIME or PART TIME

. . . . *It Pays its Way*

"Tom Thumb" Threading Machine

Many an OSTER "TOM THUMB" No. 531 works alongside a big bolt machine, filling in when the big fellow is "tied up" on long runs—getting the short runs which it completes before the big one can be set up.

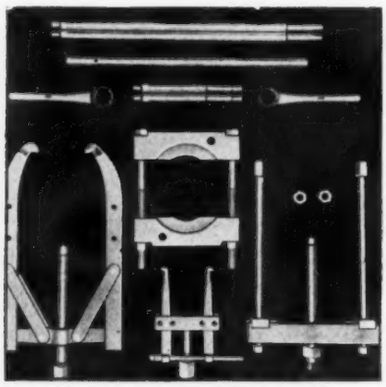
Also a wise choice for the shop which can't keep a big machine profitably busy, the "TOM THUMB" gives surprisingly high and accurate production. Powered by a universal, reversible, variable speed motor, it is simple and economical to operate, and its all BALL BEARING construction insures years of hard service.

Write for the unusually low price and complete description of the "TOM THUMB."

Sales Office: 2049 East 61st Street, Cleveland, Ohio.
Factories: Erie, Penna., and Cleveland, Ohio.
New York City Office: 30 Church St.
Philadelphia Office: 111 No. 3rd St.

OSTER THREADING EQUIPMENT WILLIAMS

THE OSTER MANUFACTURING COMPANY

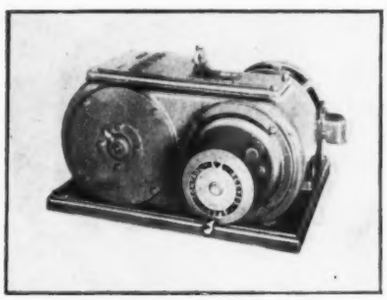


Owatonna Tool Co., 353 Cedar St., Owatonna, Minn. All tools are universal in scope, making it an easy job to remove and replace gears. bearings, wheels, pulleys and other close-fitting parts.

A wide range of adjustments permits these tools to handle the majority of maintenance jobs in any plant. Positive gripping, non-slipping features promote safety. Bearings and other parts which formerly had to be removed and replaced by the "punch and chisel" method, can now be removed and replaced without damage. Set illustrated can be purchased as shown or in individual parts. It weighs 236 lb. complete, mounted on a 4x4-ft. board.

Improved Reeves "Speedial" Combines Indicator and Control

Reeves Pulley Co., Columbus, Ind., has developed an improved type of combination handwheel and speed indicator for use with its variable-speed transmission, "Vari-speed" motor pulley and "Motodrive." Known as the "Speedial," this device accurately indicates speed settings of the various units. Actual indication is a definite number of turns of the speed shifting screw. For each full turn of the shifting screw, the indicator pointer regis-

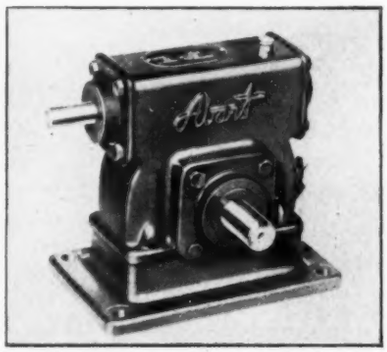


ters one point or degree on the circular scale.

It is offered as optional equipment in place of the standard speed control handwheel and indicator on the various Reeves drives. It is available for use both on new units and on units already in service. While the standard unit is calibrated in turns of the shifting screw, space is available for the user to write his own calibrations in whatever corresponding units he prefers. Depending upon the speed ratio of the unit with which the device is to be used, gear ratios of 20:1, 30:1 and 60:1 are available. Dial is calibrated in accordance with these ratios in from 0 to 20, 0 to 30 and 0 to 60 turns of the shifting screw.

Worm Speed Reducer Handles Small Loads

To supplement its line of speed reducers, Abart Gear & Machine Co., 4832 W. 16th St., Chicago, Ill., has developed an intermediate line of



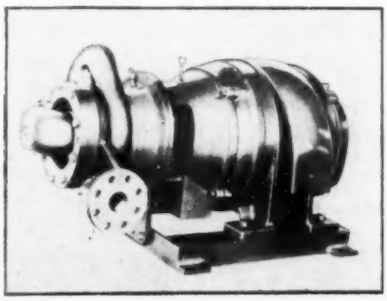
worm reduction units capable of handling power inputs up to 2 hp. Designated as Type 2⅝ A, these new units weigh 22 lb., with ratios ranging from 4 5/6:1 to 100:1.

Worms are made of alloy steel, with hardened and ground threads. Nickel bronze is used for the worm wheel. Shaft mountings are on full ball bearings. Gears, wheel and worm are assembled in an oil-tight semi-steel housing with bearing supports for both worm and wheel machined in one casting.

Allis-Chalmers Extends Multi-Stage Pump Line

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has extended its line of multi-stage "SSUnit" pumps to include a two-stage pump with 4-in. suction and 2-in. discharge, which can be rated up to 275 gal. per min. against heads up to 50 ft. at a speed of 3,550 r.p.m.

This pump, in which the motor and



pump housings are bolted together for compactness, has a cast iron casing and cover and is bronze fitted throughout. Cover can readily be removed, permitting inside parts to be replaced without disconnecting suction and discharge piping. Stuffing box is subjected to suction pressure only. This unit can be furnished with either an open, splash-proof, totally inclosed or explosion-proof motor.

Flashlight Bulb Extension Reaches Cramped Places

For the machinist and tool operator who needs a closely spotted light in hard-to-see places, a novel flashlight bulb extension has been developed by Sierra Aircraft Co., Sierra Madre, Calif. Internal bores on a lathe or boring mill, inside of a gear train, spaces under machines, and interiors of equipment such as tanks, barrels, motors, etc., are all easily illuminated with this device.

Available in lengths from 6 to 36 in., the extension has a plug which

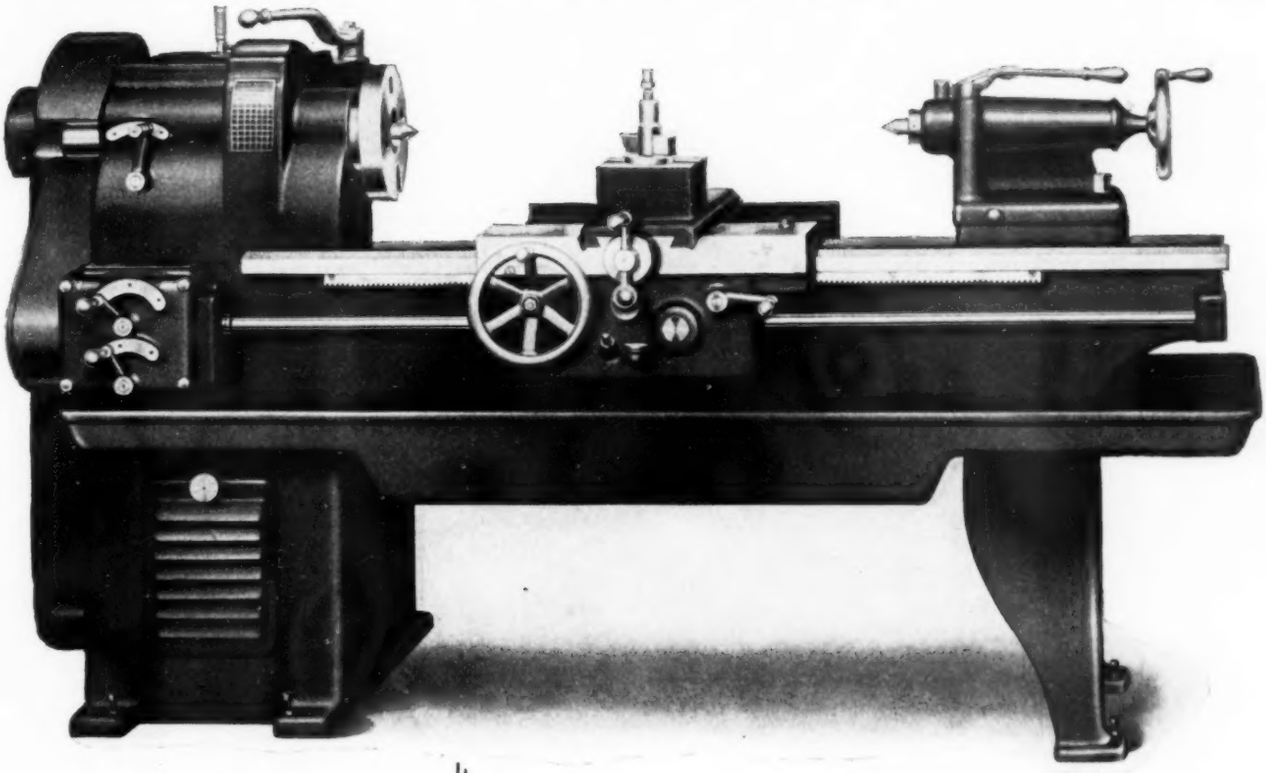
will screw into any flashlight and a socket accommodating the bulb on the other end. Made of high quality aluminum, it is extremely flexible.

"Wrigraph Industro" Drafter Fits Drawings 24 x 36 In.

A completely adjustable ball-bearing drafting machine for drawings up to 24x36 in. has been made available by L. G. Wright, Inc., 5209-4 Euclid Ave., Cleveland, Ohio. Marketed under the name of "Wrigraph Industro" Drafter, this unit is a precision instrument which can be clamped to any drawing board up to two inches thick and 36 in. wide.

The machine has a hinged mounting, permitting it to be raised clear of the board. A leveling screw is provided to adjust it to the plane of the board. It is equipped with exclusive eccentric adjustments through

Here's the NEW 16" and 18"
FEDERAL MANUFACTURING LATHE



Available for Immediate Shipment

●

CONDENSED SPECIFICATIONS

Swing over ways: 18" and 20" for 16" and 18" models respectively.
Minimum distance between centers, 32"—6 bed.
Spindle speeds: 6; range: 75 to 375 R.P.M.
Feeds: cuts per inch: .010 to .100.
Net weight: 16" 2850#; 18", 3000#.
Export Shipping Weight: 16", 3350#; 18", 3500#.

..offering tried and proved modern features for fast, accurate work

All details have been designed and developed for maximum productivity and accuracy in boring and turning—to simplify operation and insure low cost.

Selective speed type headstock provides six speeds and is flood lubricated. All spindle speeds are obtained by manipulation of two conveniently located levers.

Spindle runs on Timken Bearings; gears are of heat treated and hardened chrome nickel alloysteel.

Bed of inverted "V" type design is heavily constructed and cross braced for utmost rigidity; apron is of single piece construction, cross braced and accurately tongued to carriage.

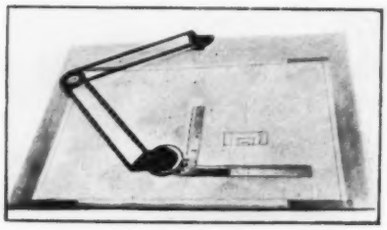
Two change levers control nine feed changes.

Drive is through vee belt from constant speed, completely enclosed motor located in base of head.

Investigate these and other modern features which are fully described in bulletin sent promptly on request.

GERARD MACHINE COMPANY, INC.
60 Park Place, NEWARK, N. J.

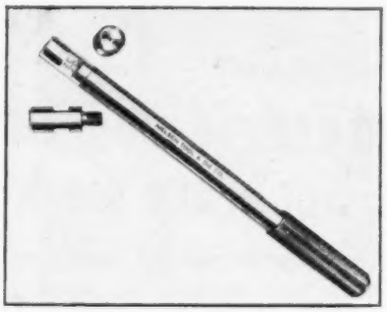
which the machine is calibrated and accuracy controlled. Arms are of special rolled channel steel giving great rigidity. Protractor head is controlled with the left hand, and the new design features a "no-set" zero.



A ½-deg. vernier equipped with a magnifier provides quick and accurate setting of all angles. Transparent-edge engine-divided scales touch the drawing paper at front and rear edges only. Four models are available.

Nielsen Layout Punches Mark Holes Through Sections

Transferring drill holes through drilled sections is made possible by the layout punches offered by Nielsen Tool & Die Co., Berkley, Mich. Available in diameters from 17/64 to 59/64 in., these punches are made with case-hardened tips which are removable for replacement. When a solid blow



is struck on the punch head, they transfer the drill center and drill circle with complete accuracy.

This method is an extension of the procedure used in transferring blind screw and stud holes with transfer screws. Among the advantages claimed for its use are its availability for either new or old work and the impossibility of layout marks becoming lost because of drill or drilling fluids erasing the markings. Center and drill circle penetrate steel to a depth of about 0.010 in.

Miniature Respirator Gives Added Convenience

A respirator so small that it can be carried in the vest pocket has been developed by H. S. Cover, South Bend, Ind. Identified as the "Dupor" No. 1, this respirator weighs only 1 oz. It can be slipped on and off as readily as a pair of spectacles. Wearer can talk, eat, sleep, smoke, without the necessity of removing it, thus assuring protection at all times.

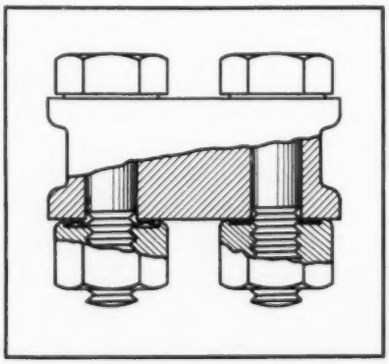
Nose piece is of soft pliable rubber which is said to make an air-tight fit over any shape nose. Filter is folded so that 9 sq.in. of filtration area is provided. Filters are easily changed. Inhalation valve keeps wearer from re-breathing stale air, and patented bulb valve exhausts

breathed air without allowing unfiltered air to enter. Respirator is so small that it does not interfere with vision or with goggles or glasses. No metal is used in its construction, making it practically unbreakable.

One Piece Lock Nut Uses New Principle

A self-contained one-piece all-metal lock nut developed by An-Cor-Lox Div. of Laminated Shim Co., 64 Union St., Glenbrook, Conn., utilizes a new locking principle to effect positive locking of the nut.

By this principle, the nut is locked to the bolt instead of to the work. The nut is simply spun on the bolt



and drawn up to the desired degree of tightness. It locks itself automatically to the bolt. The metal locking ring at the bottom of the nut is expanded by the locking pressure into the root of the bolt thread and against the nut rim. This lock joint holds securely under all conditions of heat and vibration. No special length of bolt is required. The An-Cor-Lox nut is claimed not to damage the bolt thread nor to mar the surface of the work. The same nut can be used over and over without loss of locking efficiency.

Alemite Foot-Operated Gun Lubricates Industrial Units

Especially adaptable for lubricating many types of industrial equipment, the Model 6697-A low-pressure volume delivery foot gun has been developed by the Alemite Div. of Stewart-Warner Corp., 1826 Diversey Parkway, Chicago, Ill.

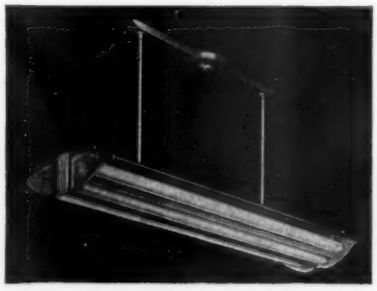
Gun has a capacity of 25 lb., and pumps approximately 1 cu.in. of grease per stroke. Maximum pressure when

operated by hand is 3,000 lb., and when operated by foot 5,000 lb. It weighs 39 lb. and stands less than 20 in. high. It is easily carried about and is provided with a broad flat base for immediate positioning. It is particularly suitable for lubricating gear boxes on large industrial equipment.

Fluorescent Drafting Lamps Provide Direct-Indirect Light

"Tru-Co-Lite" fluorescent lighting units designed by Edwin F. Guth Co., 2615 Washington Blvd., St. Louis, Mo., are said to provide a type of lighting equivalent to combination direct and indirect illumination, which is especially suitable for drafting and other close work.

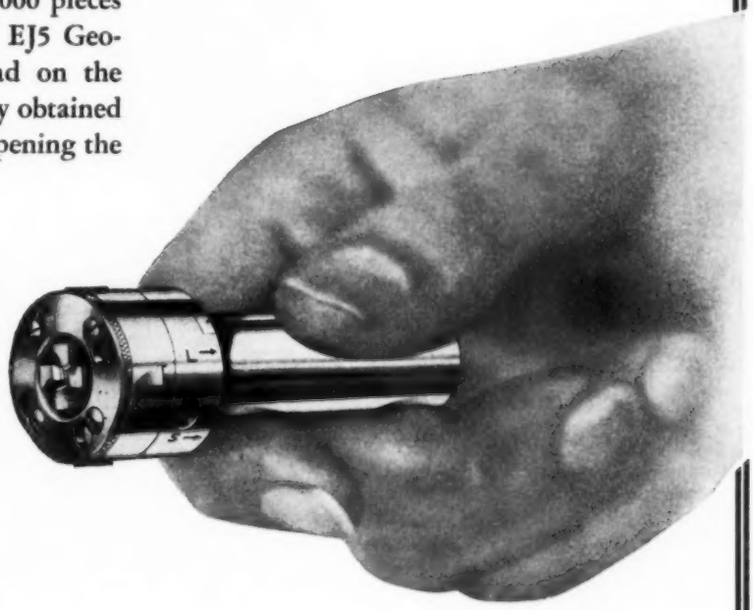
Fixture is sturdily built with reinforcing cast aluminum ends. Aluminum reflectors finished by the Alzak process deliver 85 per cent downlight



103,000 PIECES

Without GRINDING CHASERS

When using solid dies, this particular customer averaged only 13,000 to 15,000 pieces per die. But by putting a 3/16″ EJ5 Geometric Solid Adjustable Die Head on the same job, on the same machine, they obtained 103,000 pieces without even resharpening the chasers.



Do You Want A Copy?

NEW BOOKLET

Just off the press is a new booklet on this $\frac{3}{16}$″ EJ5 Removable Chaser Die Head. A copy of this EJ5 booklet will be sent you on request.

The illustration above shows actual size, the 3/16″ Style EJ5 Solid Adjustable Die Head. Only one inch in diameter, this tool will cut small diameter, fine pitch threads smoothly, accurately and economically.

The threading range is from No. 0 to No. 10 diameters inclusive, in pitches as fine as 100 threads per inch. Because the chasers are adjustable within the head, you can cut the desired decimal pitch diameter. The fact that the chasers are removable means easy and quick resharpening—plus a long total chaser life.

Couldn't you use such a tool on your work? Complete details on request.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN, CONN.

Specialists in threading tools since 1895.

with wide light distribution, and 15 per cent uplight for ceiling illumination. Unit is available for four 40-watt lamps or four 20-watt lamps. It is wired complete with 95-100 per cent power factor accessories.

Safety Goggles for Gages Developed by Ashcroft

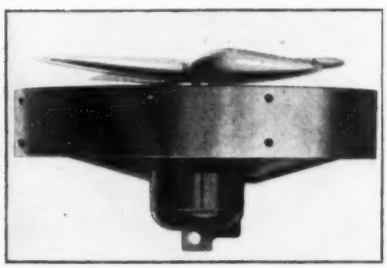
Safety is the most important of several features of the "Durafront" plastic gage cover developed by Ashcroft Gage Div. of Manning, Maxwell & Moore, Inc., Bridgeport, Conn. These plastic gage fronts are said to eliminate all possibility of work-

ers being injured by broken or flying gage glass. They are molded of crystal-clear plastic having a tensile strength of 5,000 lb. and a compression strength of 15,000 lb. Said to increase visibility of gages and at the same time improve appearance, they are available in 3½, 4½, and 6 in. sizes, and can be added to any plastic gage now in service.

"Truflo" Roof Fans Increase Air Removal

Truflo Fan Co., 557 Main St., Harmony, Pa., has developed a line of roof ventilating fans recommended where it is necessary to increase air removal in gravity type ventilators, or when wind velocity is not sufficient to ventilate the building.

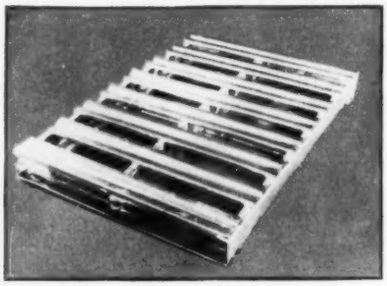
These fans are available in 18, 24,



30, 36, 42 and 48 in. sizes, with exhaust capacities ranging from 2,000 to 40,000 cu.ft. per min. Propellers are of high-quality cast aluminum alloy. Motors can be had in open, totally inclosed, totally inclosed fan cooled, and explosion proof types.

Palmer Shile All-Steel Pallets Constructed With Sectional Faces

A sectional-face all-steel pallet for use with fork trucks has been developed by Palmer Shile Co., 7100 W. Jefferson Ave., Detroit, Mich. Contrasted to the standard practice of using a solid face of corrugated steel, this pallet is made up of 6-in. channels with a heavy corrugated center

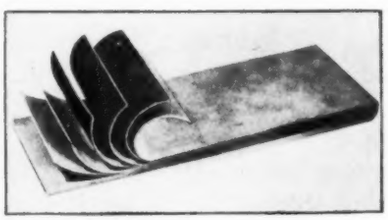


rib. The formed sections are stronger and allow use of lighter gage material, with an accompanying saving in weight.

This type of pallet is practical for use with hand fork trucks. Opening between sections is of sufficient width, on the bottom face, to allow small roller wheels to touch the floor.

"Fabco" Power Belting Has Multiple Plies

Available from Fabreeka Products Co., Boston, Mass., "Fabco" power belting is said to be the first belting priced for general-purpose power transmission to offer the advantages of multiple thin-ply construction. This type of construction gives the belt extremely high flexibility, and per-



mits it to withstand successfully severe distortion in passing over small pulleys. As a consequence, longer service without takeups and with smoother operation is claimed.

"Sealed-Flo" Lighting Fixture Protects Lamps from Dirt

The "Sealed-Flo" fluorescent lighting unit offered by Benjamin Electric Mfg. Co., 120-128 S. Sangamon St., Des Plaines, Ill., features a sealed cover construction which not only protects the lamps and reflecting surfaces from dust and dirt, but also extends the use of fluorescent lighting to locations requiring vapor-proof and dust-tight fixtures.

Protective cover with which the

units are equipped is specially constructed to permit easy servicing. Cover is hinged to lamp housing and locked in place by hand-operated cover clamps. When opened, it hangs straight down for easy servicing. This unit is recommended for locations where lighting equipment is subject to the most adverse atmospheric conditions, such as steam, dampness, noncombustible dusts and vapors. Units are available for either two or three 48-in. fluorescent lamps.

Improved "Jetalizing" Process Protects Steel Surfaces

Hanson-Van Winkle-Munning Co., Matawan, N. J., has announced an improvement in the "Jetal" process for applying a black corrosion-resistant finish to steel. The process has been changed to a two-bath system which yields a deeper black coating and at the same time permits simpler manipulation and control of the solution.

All steels, except those high in nickel or chromium, can be colored black by the process. Cast iron and some special steels may require deviation from the routine procedure. Only two tanks of ordinary iron or steel are required, along with another tank for the rinse bath. Time required for the dips varies with the class of work, but in general ranges from about 2 to 5 min. in each tank.

Milburn Ointments Give Skin Protection

A series of creams and ointments have been developed by Milburn, 905 Henry St., Detroit, Mich., to provide industrial skin protection. They are compounded to apply an extra layer or coating, consisting of ingredients that are insoluble in the specific chemical or chemicals to be combated. There are three major classifications. "Ply" Nos. 1 and 2 are applied like vanishing cream, while "Ply" No. 6 is of the ointment variety. "Ply" No. 1 is used for protection against dirty grease and oil, paint in all forms, asphalt, tar, printing-ink, greases, waxes and pitch. Protection against petroleum products, cooling lubricants and cutting compounds is furnished by "Ply" No. 2. "Ply" No. 6 is for protection against acids.

NEW MATERIALS

Tamms Layout Dope Will Not Rub Off

Tamms Silica Co., 228 N. LaSalle St., Chicago, Ill., has developed a layout dope especially suitable for tool and die makers' use. Known as "Tamms Blue Layout Dope," it comes in liquid form ready for immediate use. It is blue in color, quick drying and will not rub off. The scribe or layout tool shows a clear, distinct line without chipping or scraping.

Two Union Steels Are Exceptionally Free Machining

Union Drawn Steel Div. of Republic Steel Corp., Cleveland, Ohio, has announced a Bessemer screw steel and an open-hearth screw steel claimed to be superior in machining qualities to the finest and fastest screw steels previously available, and to be superior in soundness and freedom from machinability variations. Developed to overcome deficiencies in other fast-machining steels, it is claimed that bar after bar of the new steels can be machined at highest speeds with a fine surface finish without reduction in tool life.

The new uniform fast cutting Bessemer steel, Union "Maxcut," has physical properties comparable to S.A.E. X 1112. Parts show a smooth fine finish when machined at 280 ft. per min. with a feed of 0.0095 in., giving an average tool life of more than eleven hours. "Maxcut" responds to cyaniding and other case-hardening processes in a manner similar to S.A.E. X 1112.

Union "Multicut," the open-hearth steel, has physical properties similar to those of S.A.E. 1115. Parts show a fine finish when machined at 275 ft. per min. with a feed of 0.0087 in., giving an average tool life of better than eight hours. "Multicut" can be carburized and hardened to a minimum case hardness of 60 Rockwell C., with either single or double quench. It produces a tough ductile core with a minimum of distortion.

"Miccrolac" Coating Protects Natural or Plated Finishes

Michigan Chrome Co., 6340 E. Jefferson Ave., Detroit, Mich., has developed a coating material known as "Miccrolac" to be used to protect and beautify metal surfaces of either natural or plated finishes.

This medium is almost perfectly clear, and dries to a high lustre. It is said to dry exceptionally fast, the type of coat applied for ordinary decorative work drying in only a few seconds' time. It offers excellent qualities of adhesion, flexibility and abra-

HERE'S "4-Square" VALUE
... from a "One-Call" Source

THOR-NADO Electric Hammer

"Slingshot" drive of this new hammer gives "a more powerful blow than any electric hammer of comparable capacity, size and weight". Meets heavy-duty needs in work on stone, wood or metal. Write GRAYBAR for folder giving full specifications.

QUIK-LIFT Electric Hoist

The Coffing "Quik-Lift" can be plugged into any AC or DC circuit connection. Has heavy-duty motor. Sensitive control permits load to be raised or lowered to a fraction of an inch. Range of models from 250 lb. to 4,000lb.capacity.Write GRAYBAR for details.

TWIST-LOCK Cord Connector

Portable tools and other leads need this "sure-power" connecting device. Plug it in, give it a twist and it's locked in place. Built by Hubbell to stand up under "slam-bang" usage in the shop. Ask GRAYBAR for details on the full line of Twist-lock receptacles, caps and other wiring devices.

SIMPLEX Cord, Cable

A tough "armor" of selenium rubber gives this cord extra strength to resist crushing, abrasion, tearing. Assures uninterrupted service from portable tools. Available in a wide range of sizes including cables for big industrial loads. GRAYBAR offers literature, samples.

When you go to GRAYBAR for electrical tools and accessories, you're sure of getting a product that's built to *stay in service*... one that meets GRAYBAR'S strict standards for electrical applications that must stand up under "slam-bang" shop conditions. What's more, because GRAYBAR sells *everything electrical*, you get the extra convenience of a "one-call" source of supply for related items. Cord, connectors and wiring accessories match up in performance with the equipment they're bought to serve on. Whatever your electrical needs, check with GRAYBAR today!

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HEADQUARTERS for FLUORESCENT
LAMPS—ACCESSORIES—REFLECTORS

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GraybaR QUALITY Since 1869
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TRADE PUBLICATIONS

BELTING Graton & Knight Co., Worcester, Mass., is circulating a catalog on transmission belting, including information on belt dressing and cements.

BORING HEADS C. C. Craley Mfg. Co., Shillington, Pa. has issued an 8-page booklet describing off-set boring heads.

CARBIDE TOOLS & DIES A 12-page booklet recently issued by Carboloy Co., Inc., 11185 E. 8 Mile Rd., Detroit, Mich., describes the application of carbide tools and dies.

DIE ACCESSORIES Rolled Thread Die Co., Worcester, Mass., has issued a stock list of dies and accessories.

DIE STEELS Application for die steel is described in an 11-page booklet circulated by Jessop Steel Co., Washington, Pa.

ELECTRIC TOOLS Illustrated Catalog 41 circulated by Skilsaw, Inc., 5033-43 Elston Ave., Chicago, Ill., includes a price list on electric tools and their accessories.

ELECTRODES A folder describing the application of stainless steel electrodes is being circulated by Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.

FILES Bulletin R6-40 describes a simplified classification of files and rasps offered by the National Bureau of Standards, U. S. Department of Commerce, Washington, D. C.

GAGES Bulletins Nos. 153, 154 and 155, circulated by Baldwin-Southwark, Division of the Baldwin Locomotive Works, Philadelphia, Pa., illustrates the application and construction of testing equipment.

HYDRAULIC CYLINDERS Bulletin No. 35-B circulated by Hannifin Mfg. Co., 621–631 So. Kolmar Ave., Chicago, Ill., discusses an improved type of high pressure hydraulic cylinders for power applications.

JACKS Machinists' and planer jacks are discussed in Bulletin 303 issued by Templeton, Kenly & Co., 1020 S. Central Ave., Chicago, Ill.

JIG GRINDERS A four-page folder circulated by Marburg Bros., Inc., 90 W. St., New York, N. Y., illustrates the construction of jig grinders.

LATHES Pratt & Whitney Div., Niles Bement-Pond Co., Hartford, Conn., has issued a 24-page illustrated bulletin describing the P&W Model C lathes.

METAL THICKNESS A leaflet issued by Kocour Co., 4724 S. Christiana Ave., Chicago, Ill., discusses a method of determining the thickness of electro-deposited metals.

MOTORS Bulletin No. F-8548, describing a.c. and d.c. fractional horsepower motors has been issued by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

NICKEL ALLOYS A 16-page guide to the uses and properties of nickel alloys has been published by the International Nickel Co., 67 Wall St., New York, N. Y.

OILERS Bulletin No. 10, circulated by Gits Bros. Mfg. Co., 1846–62 So. Kilbourn Ave., Chicago, Ill., discusses sight gravity and wick feed oilers.

PORTABLE GRINDERS Norton Co., Worcester, Mass., has issued a 21-page booklet which describes grinding tools with portable equipment.

SAFETY EQUIPMENT The Boyer-Campbell Co., 6540 Antoine St., Detroit, Mich., describes equipment for eye, face and head protection, machine tool guards, etc., in its Catalog 40.

SMALL TOOLS Two pamphlets issued by Reed Small Tool Works, Worcester, Mass., lists prices and sizes of knurls and micrometers.

SPUN HEADS A 132-page manual covering various types of spun heads has been issued by Lukens Steel Co., Coatesville, Pa.

STARTER—Type CR7006-D50 magnetic starters are described in a four-page illustrated folder, No. GEA-3250, issued by General Electric Co., Schenectady, N. Y.

STEEL CUTTING Bulletins Nos. G-401, 402, published by Fansteel Metallurgical Corp., North Chicago, Ill., describe welded tip and brazed tip tools for cutting steel.

STEEL PRODUCTS Joseph T. Ryerson & Son, Inc., 203 Westside Ave., Jersey City, N. J., has published a guide to large and diversified stocks of steel and allied products available for immediate shipment.

TAP SHARPENERS "Hybco," a precision tap sharpener, is described in a 6-page pamphlet circulated by Henry P. Boggis & Co., 410 West Lakeside Ave., Cleveland, Ohio.

TRANSMISSION EQUIPMENT Boston Gear Works, Inc., North Quincy, Mass., describes a complete line of power transmission equipment in Catalog 53.

TURRET LATHES Gisholt Machine Co., Madison, Wis., has published a 24-page booklet illustrating standard tools for high production turret lathes.

NEW BOOKS

MATERIALS OF CONSTRUCTION —*By the late J. B. Johnson, rewritten by M. O. Withey, Professor of Mechanics in the University of Wisconsin, and James Aston, Consulting Metallurgist, A. M. Byers Co. 867 pages. Published by John Wiley & Sons, Inc., New York, N. Y. $6.*

This eighth edition of Johnson's "Materials of Construction" incorporates extensive revisions; much of the statistical data have been brought up to date. The first three chapters have been revised to include new definitions, column formulae, formulae for strength and deflection of flat plates, information on elastic break-down, new testing machines and apparatus, and improved methods of testing. In the chapters on timber, information on termites, plywood and joint fastenings and new grading rules for structural timbers are presented.

Well known as a text and as a reference book during the forty years that have passed since Dean J. B. Johnson prepared the first edition of "Materials of Construction," this new edition will be even more useful to students and engineers requiring a knowledge of the mechanical properties of materials employed in construction.

The authors of the eighth edition have consistently maintained the broad scope of previous editions. Their aim has been to provide the essential information concerning the sources, manufacture or fabrication of the principal materials; to give carefully selected data covering the more important mechanical and physical properties, and the influences of various factors upon these properties; to show the causes of defects and variations and how they may be discovered; to furnish and acquaint them with the technique of testing materials; and to present to the students some of the more general uses of the different materials. Diagrams and charts are used in presenting facts and laws. Tables have been omitted wherever possible, just as in previous editions.

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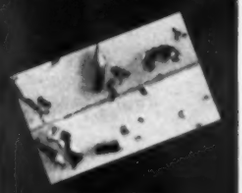

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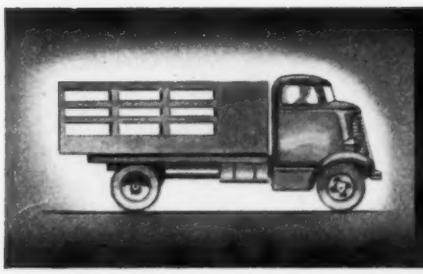

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